**Raytheon** Aircraft

# DH 125 Series 400A

(Mod.252550)

# Aircraft Maintenance Manual

## Volume 1

## Introduction thru Chapter 27

CAUTION: Do not remove pages from this book unless instructed to do so, by an Authorized Letter of Transmittal.

NOTE: In the USA the 125 is known as the DH 125 (for Airplanes prior to NA 753) or the BH 125 ( for Airplanes NA 753 and subsequent).
These different identities have no effect on the contents of this manual.

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**P/N: MM 125 - F400AGV1-V2**
**Issued: January 1978**

**Rev: 112**
**Dated: June 2003**

**Raytheon** Aircraft

# DH 125 Series 400A

(Mod.252550)

# Aircraft Maintenance Manual

## Volume 2
## Chapter 28 thru Chapter 57

CAUTION: Do not remove pages from this book unless instructed to do so, by an Authorized Letter of Transmittal.

NOTE: In the USA the 125 is known as the DH 125 (for Airplanes prior to NA 753) or the BH 125 ( for Airplanes NA 753 and subsequent).
These different identities have no effect on the contents of this manual.

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**Issued: January 1978**

**Rev: 112**
**Dated: June 2003**

Published By
**RAYTHEON AIRCRAFT COMPANY**
P.O. Box 85
Wichita, Kansas 67201
U.S.A.

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ECCN: 9E991
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**Raytheon** **Raytheon Aircraft Company**

Member of GAMA
GAMA General Aviation Manufacturers Association

# RECORD OF REVISIONS (NORMAL)

Revisions embodied in this manual, which have been issued by an approval authorization other than Raytheon Aircraft Company, must be recorded on separate record sheets.

| REV NO. | REVISION DATE | INSERTION DATE | BY |
|---|---|---|---|
| 98 | **NOTE: Revisions No. 1 to 105 inclusive were issued by Design Authorities other than Raytheon Aircraft Company. Refer to previous Record of Revisions sheet and Letters of Transmittal for details.** | | |
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| 106 | 09/98 | 12/10/98 | ATP/RC |
| 107 | 05/99 | 09/30/99 | ATP/VM |
| 108 | 12/99 | 05/11/00 | ATP/MG |
| 109 | 02/00 | 06/08/00 | ATP/MG |
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| 111 | 6/02 | 10/24/02 | ATP/MB |
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## RECORD OF REVISIONS (NORMAL)

(British Aerospace revisions)

Complete this record upon the entry of all NORMAL revisions issued by British Aerospace : Aircraft Group, Hatfield - Chester Division.

The introduction of data by revision or amendment or temporary revision or amendments not certified in accordance with British Civil Airworthiness Requirements, Chapter A6-2, will invalidate the initial certification on the title page of the manual relative to the part revised. Revision or amendments or temporary revision or amendments embodied in this manual which have been certified by an approved Design Organisation other than that applicable to the initial certification must be recorded on separate record sheets.

| Rev. No. | Insertion date | By |
|---|---|---|
| Revisions 1 to 70 incorporated by Manufacturer | | |
| 71 | 26th May 82 | FMH |
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| Rev. No. | Insertion date | By |
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| 85 | 26th May 82 | FMH |
| 86 | | |
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| 88 | 30th June 82 | FMH |
| 89 | 22·2·83 | FMH |
| 90 | 5·8·83 | FMH |
| 91 | 11-5·84 | |
| 92 | 9-7-84 | |
| 93 | 26-2-86 | |
| 94 | 12-4-91 | RH |
| 95 | 12-4-91 | RH |
| 96 | 12-4-91 | RH |
| 97 | 12-4-91 | RH |
| 98 | 12-4-91 | RH |
| 99 | 7-4-92 | J.W. |
| 100 | 15-6-92 | JG |
| 101 | 29·3·93 | J.W. |
| 102 | 21-4-93 | JM |

...Record of revisions (Normal) continued

| Rev. No. | Insertion date | By |
|---|---|---|
| 103 | 26-10-93 | J.W. |
| 104 | 4-21-94 | ATP/MH |
| 105 | 7/27/95 | ATP/GW |
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DO NOT USE THIS SHEET FOR RECORDING THE INCORPORATION OF ANY FUTURE REVISIONS USE THE NEW SHEET ISSUED BY RAYTHEON AIRCRAFT COMPANY.

# RECORD OF TEMPORARY REVISIONS

Revisions embodied in this manual, which have been issued by an approval authorization other than Raytheon Aircraft Company, must be recorded on separate record sheets.

<table>
<tr><th rowspan="2">LOT NO.</th><th rowspan="2">Temporary Revision No.</th><th colspan="2">Affecting</th><th colspan="2">Inserted</th><th colspan="2">Removed</th></tr>
<tr><th>Part</th><th>Page</th><th>By</th><th>Date</th><th>By Revision No.</th><th>Date</th></tr>
<tr><td>1</td><td></td><td colspan="6" rowspan="7"><b>NOTE: Temporary revisions No. 1 to 7 inclusive were issued by Design Authorities other than Raytheon Aircraft Company. Refer to previous Record of Revisions sheet and Letters of Transmittal for details. Temporary revision No.8 and subsequent will be issued by Raytheon Aircraft Company.</b></td></tr>
<tr><td>2</td><td></td></tr>
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<tr><td>8</td><td>GEN-1</td><td colspan="2">Refer to LOT</td><td></td><td></td><td></td><td></td></tr>
<tr><td>9</td><td>20-1</td><td>20-95-11</td><td>3</td><td></td><td></td><td></td><td></td></tr>
<tr><td>10</td><td>32-3</td><td>32-30-11</td><td>501</td><td></td><td></td><td></td><td></td></tr>
<tr><td>11</td><td>27-1</td><td>27-20-03</td><td>1</td><td>ATP/RC</td><td>12-10-98</td><td>108</td><td>05/11/00</td></tr>
<tr><td>12</td><td>32-4</td><td>32-10-11</td><td>202</td><td>ATP/JB</td><td>8/2/06</td><td></td><td></td></tr>
<tr><td>13</td><td>12-2</td><td>12-30-00</td><td>303</td><td>ATP/RD</td><td>1/13/2010</td><td></td><td></td></tr>
<tr><td>14</td><td>35-1</td><td>35-10-14</td><td>202</td><td>ATP/RD</td><td>1/13/2010</td><td></td><td></td></tr>
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| LOT NO. | Temporary Revision No. | Affecting | | Inserted | | Removed | |
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## RECORD OF TEMPORARY REVISIONS

| Letter of Transmittal No. | Temporary Revisions No. | Affecting | Cancelled by |
|---|---|---|---|
| 1 | 24-1 | 24-30-21 | Rev 85 |
| 2 | 32-1 | 32-10-03 | Rev 92 |
| 5 | 32-2 | 32-10-11 P.209 | Rev.99 |
| 6 | 26-1<br>26-2 | 26-20 P.201<br>26-20-12 P.201 | Rev 100 |
| 7 | 24-2<br>26-1<br>26-2 | 24-30-21 P.205<br>26-20 P.201<br>26-20-12 P.201 | Rev 101 |
| 8 | GEN-1 | 7-10 pg1<br>12-00 pg1<br>27-00 pg1<br>32-00 pg1 | |
| 9 | 20-1 | 20-95-11:3 | |
| 10 | 32-3 | 32-30-11:201 | |
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DO NOT USE THIS SHEET FOR RECORDING THE INCORPORATION OF ANY FUTURE TEMPORARY REVISIONS, USE THE NEW SHEET ISSUED BY RAYTHEON AIRCRAFT COMPANY

## Hawker Beechcraft Corporation

# DH 125 SERIES 400A (Mod.252550)
# Aircraft Maintenance Manual

Hawker Beechcraft Corporation
PO Box 85
Wichita, Kansas
67201-0085 USA

Manual Reference: P/N: MM 125 - F400AGV1-V2

# Letter of Transmittal - No.14
# for
# Temporary Revision TR 35-1

## 1. Reason for Issue

TR 35-1 Chapter 35-10-14, 201 paragraph 1.B. (3) revised. Minimum clearance between upper (3rd) oxygen cylinder and rudder control cable changed from 0.5 to 0.25 inch. Minimum clearance of 1.0 inch between oxygen pipes and electrical equipment added.

## 2. Instructions

(1) For printed manuals: Insert the Temporary Revision as detailed below.

(2) Record the insertion of this Temporary Revision on the RECORD OF TEMPORARY REVISIONS sheet.

(3) Insert this Letter of Transmittal immediately following the RECORD OF TEMPORARY REVISIONS sheet.

| TR No. | Position | Instructions |
|---|---|---|
| 35-1 | Chapter 35-10-14, facing page 202 (OXYGEN CYLINDER ASSEMBLY - MAINTENANCE PRACTICES). | INSERT |

## 3. Action

TR 35-1. In place of Chapter 35-10-14 page block 201, paragraph 1.B. (3) read paragraph 1.B. (3) of this TR.

## 4. List of Current Temporary Revisions (Manual at Revision 112 standard)

**NOTE:** Temporary Revisions are only to be removed from the manual when specific instructions are given in a Letter of Transmittal issued with a NORMAL or TEMPORARY Revision.

| TR No. | Position | Issued with LOT No. |
|---|---|---|
| 32-4 | Facing Chapter 32-10-11, Page 202. | 12 |
| 12-2 | Immediately facing page 303, Chapter 12-30-00. | 13 |
| 35-1 | Facing page 202, Chapter 35-10-14, (OXYGEN CYLINDER ASSEMBLY - MAINTENANCE PRACTICES). | 14 |

# Hawker Beechcraft Corporation

125 AIRCRAFT MAINTENANCE MANUAL
(Manual Ref. MM 125-F400AGV1-V2)

## TEMPORARY REVISION
## LETTER OF TRANSMITTAL No.13

Hawker Beechcraft Corporation,
PO Box 85,
Wichita,
Kansas 67201,
U.S.A.

### Reason for issue

Provides additional instructions on the application of de-ice/anti-ice fluids and the removal of thickened residue that may result from using these fluids.

### Instructions

(1) For printed manuals : Insert Temporary Revision as detailed below.

For microfilm manuals : Insert Temporary Revision as detailed below, in the TEMPORARY REVISIONS AND AVIONIC FIT DATA binder.

For microfiche manuals : Insert Temporary Revision as detailed below, in the TEMPORARY REVISIONS AND AVIONIC FIT DATA binder.

(2) Record the completion of this Temporary Revision on the RECORD OF TEMPORARY REVISIONS sheet.

(3) Insert this Letter of transmittal immediately following the RECORD OF TEMPORARY REVISIONS sheet.

| **TR No.** | **Position** | **Instructions** |
|---|---|---|
| 12-2 | Immediately before page 303, Chapter 12-30-00. | INSERT |

### Action

This TR replaces Paragraph 2, on page 303, through to the end of Chapter 12-30-00, page block 301.

## List of Current Temporary Revisions (Manual at Revision 112 standard)

NOTE: Temporary Revisions are only to be removed from the manual when specific instructions are given in a Letter of Transmittal issued with a NORMAL or TEMPORARY Revision.

| TR No. | Position | Issued with LOT No. |
|---|---|---|
| 32-4 | Facing Chapter 32-10-11, Page 202. | 12 |
| 12-2 | Immediately before page 303, Chapter 12-30-00. | 13 |

# **Raytheon** Aircraft Company

125 AIRCRAFT MAINTENANCE MANUAL
(Manual Ref. MM 125-F400AGV1-V2)

## TEMPORARY REVISION
## LETTER OF TRANSMITTAL No.12

Raytheon Aircraft Company
PO Box 85
Wichita
Kansas 67201-0085
U.S.A.

## Reason for issue

To introduce main landing gear trunnion bolt torque values.

## Instructions

(1) For printed manuals : Insert Temporary Revision as detailed below.

For microfilm manuals : Insert Temporary Revision as detailed below, in the TEMPORARY REVISIONS AND AVIONIC FIT DATA binder.

For microfiche manuals : Insert Temporary Revision as detailed below, in the TEMPORARY REVISIONS AND AVIONIC FIT DATA binder.

(2) Record the completion of this Temporary Revision on the RECORD OF TEMPORARY REVISIONS sheet.

(3) Insert this Letter of transmittal immediately following the RECORD OF TEMPORARY REVISIONS sheet.

| TR No. | Position | Instructions |
|---|---|---|
| 32-4 | Facing Chapter 32-10-11, Page 202. | INSERT |

## Action

In place of Chapter 32-10-11 page block 201, Paragraph 2. Removal/Installation, read this TR.

## List of Current Temporary Revisions (Manual at Revision 112 standard)

NOTE: Temporary Revisions are only to be removed from the manual when specific instructions are given in a Letter of Transmittal issued with a NORMAL or TEMPORARY Revision.

| TR No. | Position | Issued with LOT No. |
|---|---|---|
| 32-4 | Facing Chapter 32-10-11, Page 202. | 12 |

**Raytheon** Aircraft

125 AIRCRAFT MAINTENANCE MANUAL

Raytheon Aircraft Company
P.O. Box 85
Wichita
Kansas 67201
USA

DH 125 SERIES 400A (WITH MOD.252550)

(P/N: MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 112

## 1. HOLDERS OF PRINTED MANUALS

(1) Make sure that Revision 111 has been incorporated.

(2) Remove and destroy Temporary Revisions detailed for removal in paragraph 4of this transmittal and cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of Volume 1.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages as instructed in paragraph 3 of this transmittal.

(4) Record the incorporation of this revision on the new RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Keep this Letter of Transmittal and file at the front of Volume 1.

## 2. HIGHLIGHTS

*NOTE: All topics/pages included in this revision have been re-issued and dated Jun.03.*

| Ch-Se-Su | Description of change |
|---|---|
| Title Page Volume 1 | Revised. Transfer of Type Certificate statement deleted and Export statement reworded. |
| LOEP LIST | Revised. |
| Introduction | Revised to the latest format. New WARNINGS and reference to the Raytheon Electronic Publication System (REPS) CD-ROM added. |
| Chapter 20 | |
| LOEP | Revised. |
| Chapter 20 | Complete Chapter 20 removed and Token page introduced. Chapter 20 information is now contained in the Aircraft Maintenance Manual, Chapter 20, Standard Practices - Airframe, P/N: AMM 125/H-20. |

| Ch-Se-Su | Description of change |
|---|---|
| Title Page<br>Volume 2 | Revised. Transfer of Type Certificate statement deleted and Export statement reworded. |
| Chapter 32 | |
| LOEP | Revised. |
| TOC | Revised. New topic 32-60-15 WARNING HORN introduced and topic 32-40-112 pb 201 replaced by pbs 301, 401 and 601. |
| 32-40-112 | MAINTENANCE PRACTICES - Page block deleted, data transferred to new page blocks, SERVICING, REMOVAL/INSTALLATION and INSPECTION/CHECK. |
| | SERVICING - New page block, data transferred from MAINTENANCE PRACTICES (No technical changes).<br>Close up added |
| | REMOVAL/INSTALLATION - New page block, data transferred from MAINTENANCE PRACTICES.<br>Maxaret unit test requirement introduced, AMM reference revised and close up added. |
| | INSPECTION/CHECK - New page block, data transferred from MAINTENANCE PRACTICES (No technical changes). |
| 32-60-15 | DESCRIPTION AND OPERATION - New page block introduced. |
| | REMOVAL/INSTALLATION - New page block introduced. |
| | ADJUSTMENT/TEST - New page block introduced. |

## 3. INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| Title Page Volume 1 | 1/2 | 1/2 | - |
| LOEP List | 1 | 1 | - |
| Introduction | 1 thru 6 | 1 thru 6 | - |
| 20 - LOEP | 1 | 1 | - |
| Chapter 20 including TOC | All | 1 Token Page | - |
| Title Page Volume 2 | 1/2 | 1/2 | - |
| 32 - LOEP | 1 thru 3 | 1 thru 3 | - |
| 32 - TOC | 1 thru3 | 1 thru 4 | - |
| 32-40-112 | 201 thru 214 | - | - |
| | - | 301 thru 304 | - |
| | - | 401 thru 403 | - |
| | - | 601 thru 610 | - |
| 32-60-15 | - | 1 thru 4 | - |
| | - | 401 | - |
| | - | 501 thru 503 | - |

## 4. TEMPORARY REVISION DATA

No Temporary Revisions have been issued at this time.

Raytheon Aircraft Company
P.O. Box 85
Wichita
Kansas 67201
USA

DH 125 SERIES 400A (WITH MOD.252550)

(P/N: MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 111

## 1. HOLDERS OF PRINTED MANUALS

(1) Make sure that Revision 110 has been incorporated.

(2) Remove and destroy Temporary Revisions detailed for removal in paragraph 5 of this transmittal and cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of Volume 1.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages as instructed in paragraph 4 of this transmittal.

(4) Remove and destroy the existing pages of the chapters which have been transferred to another manual.

(5) Record the incorporation of this revision on the new RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(6) Keep this Letter of Transmittal and file at the front of Volume 1.

## 2. HOLDERS OF MICROFILM

(1) Remove and destroy temporary revisions from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed for removal in paragraph 5 of this transmittal. Cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the binder.

(2) Remove the Microfilm at Revision 110.

(3) Insert the Microfilm at Revision 111.

## 3. HIGHLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| Title Page Volume 1 | Revised. |
| Title Page Volume 2 | Revised. |

| Ch-Se-Su | Description of change |
|---|---|
| LOEP List | Revised. |
| Chapters | |
| 20 - LOEP | Revised. |
| 20 - CONTENTS | Revised to reflect the same wording as manual 125/H-20 Chapters. |
| 20-10-447 | Deleted - covered in 125/H-20. |
| 20-10-481 | Deleted - covered in 125/H-20. |
| 20-10-482 | Deleted - covered in 125/H-20. |
| 20-10-499 | Deleted - covered in 125/H-20. |
| 20-10-811 | Deleted - covered in 125/H-20. |
| 20-10-3003 | Deleted - covered in 125/H-20. |
| 20-10-3008 | Deleted - covered in 125/H-20. |
| 20-10-4005 | Deleted - covered in 125/H-20. |
| 20-10-4007 | Deleted - covered in 125/H-20. |
| 20-10-4012 | Deleted - covered in 125/H-20. |
| 20-10-4014 | Deleted - covered in 125/H-20. |
| 20-10-4507 | Deleted - covered in 125/H-20. |
| 20-10-5016 | Deleted - covered in 125/H-20. |
| 20-11-1019 | Deleted - superseded by Chapter 20-10-3537 (125/H-20). |
| 20-11-1040 | Deleted - covered in 125/H-20. |
| 20-21-00 | Deleted - superseded by Chapter 20-10-3528 (125/H-20). |
| 20-22-00 | Deleted - superseded by Chapter 20-10-3528 (125/H-20). |

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| Title Page Volume 1 | 1/2 | 1/2 | - |
| Title Page Volume 2 | 1/2 | 1/2 | - |
| LOEP List | 1 | 1 | - |
| Chapters | | | |
| 20 - LOEP | 1 to 5 | 1 | - |
| 20 - TOC | 1 to 5 | 1 to 5 | - |
| 20-10-447 | 1 to 5 | - | - |
| 20-10-481 | 1 to 3 | - | - |
| 20-10-482 | 1/2 | - | - |
| 20-10-499 | 1 to 5 | - | - |
| 20-10-811 | 1/2 | - | - |
| 20-10-3003 | 1 to 6 | - | - |
| 20-10-3008 | 1 to 4 | - | - |
| 20-10-4005 | 1 to 5 | - | - |
| 20-10-4007 | 1 to 4 | - | - |
| 20-10-4012 | 1 to 5 | - | - |
| 20-10-4014 | 1 to 3 | - | - |
| 20-10-4507 | 1 to 6 | - | - |
| 20-10-5016 | 201 to 231 | - | - |
| 20-11-1019 | 1 to 7 | - | - |
| 20-11-1040 | 1 to 4 | - | - |
| 20-21-00 | 1 to 3 | - | - |
| 20-22-00 | 1 | - | - |

## 5. TEMPORARY REVISION DATA

No Temporary Revisions have been issued at this time.

Raytheon Aircraft Company
P.O. Box 85
Wichita
Kansas 67201
USA

DH 125 SERIES 400A (WITH MOD.252550)

(P/N: MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 110

As part of the continuing manual improvement program of the Hawker/125 manuals, Raytheon Aircraft Company has issued Chapter 20, STANDARD PRACTICES - AIRFRAME, as a separate publication, manual reference 125/H-20.

Revision 2 of manual 125/H-20 introduces Chapters 20-10-08, 20-10-31, 20-10-32, 20-10-33, 20-10-75, 20-10-312, 20-10-3504, 20-90-00, 20-90-11, 20-90-21, 20-90-31, 20-90-41, 20-92-41, 20-92-42, 20-92-63, 20-92-64, 20-92-65, 20-92-71, 20-92-83, 20-92-111, 20-92-121, 20-92-123, 20-92-125, 20-92-131, 20-92-132, 20-92-141, 20-92-161, 20-92-162, 20-92-191, 20-92-192, 20-92-201, 20-92-202, and 20-92-204. Because of this change, all of the above chapters will be removed from this AMM at this revision. Chapter 20-10-4 in this AMM becomes Chapter 20-10-08 in Revision 2 of Manual 125/H-20. Chapter 20-90-0 in this AMM becomes Chapter 20-90-00 in Revision 2 of Manual 125/H-20.

Chapters 20-00-00, 20-10-34, 20-10-40, 20-10-42, 20-10-50, 20-10-354, 20-10-355, 20-10-4553, 20-30-100, 20-92-22 and 20-92-203 have also been added to Manual 125H/20 at Revision 2, but were not previously contained in this AMM

## 1. HOLDERS OF PRINTED MANUALS

(1) Make sure that Revision 109 has been incorporated.

(2) Remove and destroy Temporary Revisions detailed for removal at paragraph 5 of this transmittal and cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages as instructed in paragraph 4 of this Letter of Transmittal.

(4) Record the incorporation of this revision on the new RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Keep this Letter of Transmittal and file at the front of Volume 1.

## 2. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove and destroy temporary revisions from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed for removal on paragraph 5 of this transmittal. Cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the binder.

(2) Remove Microfilm or Microfiche at Revision 109.

(3) Insert Microfilm or Microfiche at Revision 110.

## 3. HIGHLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| **TITLE PAGE VOLUME 1** | Revised |
| **TITLE PAGE VOLUME 2** | Revised |
| **LOEP LIST** | Revised |
| **Chapter 20** | |
| 20 - LOEP | Revised |
| 20 - CONTENTS | Revised to reflect the same wording as manual 125/H-20 Chapters. |
| 20-10-4 | Deleted - covered by topic 20-10-08 in a separate publication issued by Raytheon Aircraft Company. |
| 20-10-31 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-10-32 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-10-33 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-10-75 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-10-312 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-10-3504 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-90-0 | Deleted - covered by topic 20-90-00 in a separate publication issued by Raytheon Aircraft Company. |
| 20-90-11 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-90-21 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-90-31 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-90-41 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-41 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-42 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-63 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-64 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-65 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-71 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-83 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |

| Ch-Se-Su | Description of change |
|---|---|
| 20-92-111 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-121 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-123 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-125 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-131 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-132 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-141 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-161 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-162 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-191 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-192 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-201 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-202 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |
| 20-92-204 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company. |

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| **TITLE PAGE VOLUME 1** | Title Page | Title Page | - |
| **TITLE PAGE VOLUME 2** | Title Page | Title Page | - |
| **LOEP LIST** | 1 | 1 | - |
| **Chapter 20** | | | |
| 20 - LOEP | All | All | - |
| 20 - CONTENTS | All | All | - |
| 20-10-4 | All | - | - |
| 20-10-31 | All | - | - |
| 20-10-32 | All | - | - |
| 20-10-33 | All | - | - |
| 20-10-75 | All | - | - |
| 20-10-312 | All | - | - |
| 20-10-3504 | All | - | - |
| 20-90-0 | All | - | - |

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 20-90-11 | All | - | - |
| 20-90-21 | All | - | - |
| 20-90-31 | All | - | - |
| 20-90-41 | All | - | - |
| 20-92-41 | All | - | - |
| 20-92-42 | All | - | - |
| 20-92-63 | All | - | - |
| 20-92-64 | All | - | - |
| 20-92-65 | All | - | - |
| 20-92-71 | All | - | - |
| 20-92-83 | All | - | - |
| 20-92-111 | All | - | - |
| 20-92-121 | All | - | - |
| 20-92-123 | All | - | - |
| 20-92-125 | All | - | - |
| 20-92-131 | All | - | - |
| 20-92-132 | All | - | - |
| 20-92-141 | All | - | - |
| 20-92-161 | All | - | - |
| 20-92-162 | All | - | - |
| 20-92-191 | All | - | - |
| 20-92-192 | All | - | - |
| 20-92-201 | All | - | - |
| 20-92-202 | All | - | - |
| 20-92-204 | All | - | - |

## 5. TEMPORARY REVISION DATA

No Temporary Revisions have been issued at this time.

Raytheon Aircraft Company
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DH 125 SERIES 400A (WITH MOD.252550)

(Manual Ref: MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 109

As part of the continuing manual improvement program of the Hawker/125 manuals, Raytheon Aircraft Company has issued Chapter 20, STANDARD PRACTICES - AIRFRAME, as a separate publication, manual reference 125/H-20.
Revision 1 of this manual introduces Chapters 20-09-20, 20-09-21, 20-09-23, 20-09-91, 20-09-111, 20-09-121, 20-09-131, 20-09-141 and 20-10-4501.
Because of this change, all of the above chapters will be removed from this AMM at this revision.
Chapters 20-09-23 and 20-10-4501 were not previously contained in this AMM.

## 1. HOLDERS OF PRINTED MANUALS

(1) Check that Revision 108 has been incorporated.

(2) Remove and destroy any pages detailed for removal as instructed in paragraph 4 of this Letter of Transmittal.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages as instructed in paragraph 4 of this Letter of Transmittal.

(4) Record the incorporation of this Revision on the new RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## 2. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove and destroy pages from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed at paragraph 5 of this transmittal.

## 3. HIGHLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| **TITLE PAGE VOLUME 1** | Revised |
| **TITLE PAGE VOLUME 2** | Revised |
| **LOEP LIST** | Revised |
| **Chapter 20** | |
| 20 - LOEP | Revised |
| 20 - CONTENTS | Revised and reformatted |
| 20-09-20 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-09-21 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-09-23 | Added to TOC at this revision - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-09-91 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-09-111 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-09-121 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-09-131 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-09-141 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-10-4501 | Added to TOC at this revision - covered in a separate publication issued by Raytheon Aircraft Company |

## 4.INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| **TITLE PAGE VOLUME 1** | Title Page | Title Page | - |
| **TITLE PAGE VOLUME 2** | Title Page | Title Page | - |
| **LOEP LIST** | 1 | 1 | - |

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| **Chapter 20** | | | |
| 20 - LOEP | All | All | - |
| 20 - CONTENTS | 1 to 3 | 1 to 6 | - |
| 20-09-20 | All | - | - |
| 20-09-21 | All | - | - |
| 20-09-91 | All | - | - |
| 20-09-111 | All | - | - |
| 20-09-121 | All | - | - |
| 20-09-131 | All | - | - |
| 20-09-141 | All | - | - |

## 5. TEMPORARY REVISION DATA

No Temporary Revisions have been issued at this time.

Raytheon Aircraft Company
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DH 125 SERIES 400A (WITH MOD.252550)

(Manual Ref: MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 108

## 1. HOLDERS OF PRINTED MANUALS

(1) Make sure that Revision 107 has been incorporated.

(2) Remove and destroy Temporary Revisions detailed for removal in Paragraph 5 of this transmittal and cancel any entries for the temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages which are replaced by revised pages as instructed at Paragraph 4.

(4) Remove and destroy pages which have been transferred to another chapter.

(5) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(6) Retain this Letter of Transmittal and file at the front of Volume 1.

## 2. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove and destroy Temporary Revisions from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed for removal in Paragraph 5 of this transmittal. Cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the binder.

## 3. HIGHLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| LOEP LIST | Revised. |
| **CHAPTER 12:** | |
| 12-LOEP | Revised. |
| 12-CONTENTS | Revised. |
| 12-21-00 | Air conditioning (SERVICING). Recommended oils for cooling turbine revised and note added. New headers added. |
| 12-28-00 | Fuel system (SERVICING). Anti-icing and biocidal additives revised and equipment/material table added with revised defuelling adaptor part numbers. Existing topics 12-28 (FUEL AND ADDITIVES - APPROVED SPECIFICATIONS) and 12-28-2 (SERVICING FUEL) reformatted into one topic. New headers added. |
| 12-32-00 | Landing gear (SERVICING). Use of dry air to inflate tires deleted. Equipment/materials table added to refer to tire inflation gauge and tire inflation trolley as local supply. |
| 12-79-00 | Engine oil (SERVICING). Capacities and consumption tables revised and note revised. New headers added. |
| **CHAPTER 21** | |
| 21-LOEP | Revised |
| 21-10-37 | Reference regulator/temperature compensator (MAINTENANCE PRACTICES). Topic information deleted due to change of manufacturers procedures. New headers added. |
| **CHAPTER 27**: | |
| 27-LOEP | Revised. |
| 27-CONTENTS | Revised. |
| 27-00-00 | Flight control - general (DESCRIPTION). Editorial changes. Reformatted and ATA number changed from 27-00. New headers added.<br>Flight control (MAINTENANCE PRACTICES). Control cable clearance guidelines added and equipment/material table item numbers revised. Reformatted and ATA number changed from 27-00. New headers added. |
| 27-20 | Rudder and rudder trim control systems (ADJUSTMENT/TEST). Airworthiness authority revised in WARNING and references revised. Reformatted and page block 201 changed to 501. New headers added. |

| Ch-Se-Su | Description of change |
|---|---|
| CHAPTER 27 Cont. | |
| 27-20-35 | Rudder pedal assembly (REMOVAL/INSTALLATION). New topic introduced to replace TR 27-1. |
| 27-30 | Elevator and elevator trim control systems (ADJUSTMENT/TEST). Airworthiness authority revised in WARNING and references revised. Reformatted and page block 201 changed to 501. New headers added. |
| 27-30-30 | Elevator mass balance assembly (INSPECTION/CHECK). New topic introduced. |
| 27-50-02 | Flap control system (ADJUSTMENT/TEST). Airworthiness authority revised in WARNING. Page block 201 changed to 501. New headers added. |
| 27-61-02 | Airbrake and lift dump control system (ADJUSTMENT/TEST). Airworthiness authority revised in WARNING. Reformatted and page block 201 changed to 501. New headers added. |
| 27-72 | Gust lock - Ailerons, elevators and throttle levers baulk (ADJUSTMENT/TEST) Airworthiness authority revised in WARNING. Reformatted and page block 201 changed to 501. New headers added. |
| **CHAPTER 28:** | |
| 28-LOEP | Revised. New page headers added. |
| 28-CONTENTS | Revised and reformatted. New headers added. |
| 28-10-12 | Tanks (MAINTENANCE PRACTICES). Equipment/Material tables added/revised. Information added for temporary repair using Click-Patch. New headers added. |
| 28-20-01 | Fuel feed system (main engines) (ADJUSTMENT/TEST). Reformatted and page block 201 changed to 501. New headers added. |
| 28-20-81 | Controls (ADJUSTMENT/TEST). Airworthiness authority revised in WARNING. Reformatted and page block 201 changed to 501. New headers added. |
| 28-43-41 | Float switches (vent surge tank) (REMOVAL/INSTALLATION). Topic introduced. |
| **CHAPTER 29:** | |
| 29-LOEP | Revised. |
| 29-00-00 | Hydraulic power - General (DESCRIPTION AND OPERATION). Hydraulic system filling WARNING revised. |

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 32:** | |
| 32-LOEP | Revised. |
| 32-CONTENTS | Revised. |
| 32-10-25 | Side stay assembly (REMOVAL/INSTALLATION). Pre-installation check of bearing race added. Equipment/material table and references revised, close up added. Reformatted and page block 201 changed to 401. New headers added.<br>Side stay assembly (ADJUSTMENT/TEST). Equipment/material table revised and close up added. Reformatted and page block 201 changed to 501. New headers added.<br>Side stay assembly (INSPECTION/CHECK). New paragraph to examine bearing race for signs of damage added. References revised and close up added. Reformatted and page block 201 changed to 601. New header added. |
| 32-20-21 | Drag stay assembly (MAINTENANCE PRACTICES). Drag stay clearance added. References revised and close up added. Reformatted and new headers added. |
| 32-30-05 | Nose gear retraction jack (REMOVAL/INSTALLATION). New topic introduced. |
| 32-40-11 | Main wheel (SERVICING). Topic to reference out to vendor CMM. Page block 201 changed to 301.<br>Main wheel (REMOVAL/INSTALLATION). Pre-installation check for main landing gear tie bolts and nuts added. NOTE to make sure wheel bearings are correctly greased added. References revised, close up added. Page block 201 changed to 401.<br>Main wheel (INSPECTION/CHECK). New topic to reference out to vendor CMM.<br>Main wheel (CLEANING and PAINTING). New topic to reference out to vendor CMM.<br>Main wheel (APPROVED REPAIRS). New topic to reference out to vendor CMM. |
| 32-40-21 | Nose wheel (SERVICING). New topic to reference out to vendor CMM.<br>Nose wheel (REMOVAL/INSTALLATION). 'This condition can in some instances be rectified....on the axle.' deleted from existing NOTE. New NOTES 'Tires must always be paired only if...' and 'Make sure that the wheel bearings are correctly greased.' added in Installation. References revised and close up added. Reformatted and page block 201 changed to 401. New headers added.<br>Nose wheel (CLEANING and PAINTING). New topic to reference out to vendor CMM.<br>Nose wheel (APPROVED REPAIRS). New topic to reference out to vendor CMM. |
| 32-40-41 | Tires (main and nose wheels) (DESCRIPTION). Main and nose tire part number tables added. CAUTION on tires fitted in pairs of the same part number amended to include tires for main and nose wheels. Date of manufacture information revised and tire marking illustrations added. Reformatted and new headers added.<br>Tires (REMOVAL/INSTALLATION). Existing information replaced by a reference out to vendor CMM. Reformatted and page block 201 changed to 401. New header added.<br>Tires (INSPECTION/CHECK). Topic introduced. |

| Ch-Se-Su | Description of change |
|---|---|
| CHAPTER 32 Cont. | |
| 32-40-71 | Brake control valve (REMOVAL/INSTALLATION). New topic introduced. |
| 32-50-00 | Steering (DESCRIPTION and OPERATION). Reformatted and ATA number changed from 32-50. New headers added.<br>Steering (ADJUSTMENT/TEST). WARNINGS and CAUTIONS added. Steering on/off valve test added. Spring strut break-out load test to reference out to CMM. Functional test of nose wheel steering added. References revised and close up added. Reformatted and ATA number changed from 32-50. Page block 201 changed to 501. |
| 32-50-11 | Steering jack (SERVICING). New topic introduced.<br>Steering jack (REMOVAL/INSTALLATION). Reformatted and page block 201 changed to 401. New headers added. |
| 32-50-12 | Steering jack selector valve (REMOVAL/INSTALLATION). New topic introduced. |
| **CHAPTER 53:** | |
| 53-LOEP | Revised and reformatted. New header added. |
| 53-40-01 | Wing/fuselage fittings (MAINTENANCE PRACTICES). Equipment/Materials table revised. Use of MPI for cracks in attachment lugs on wings and fuselage added. Reformatted and new headers added. |
| **CHAPTER 55:** | |
| 55-LOEP | Revised and reformatted. New header added. |
| 55-CONTENTS | Revised and reformatted. New header added. |
| 55-13-00 | Horizontal stabilizer (REMOVAL/INSTALLATION). NOTE added to call for a check of incidence, dihedral and symmetry only for the installation of a new or replacement horizontal stabilizer. Equipment/material tables and references revised. Reformatted and page block 201 changed to 401. |

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 56:** | |
| 56-LOEP | Revised. |
| 56-CONTENTS | Revised and reformatted. New header added. |
| 56-10-11 | Window panel A (MAINTENANCE PRACTICES). Information for Inspection/Check and Approved Repairs reference to SRM added. |
| 56-10-21 | Window panel B (MAINTENANCE PRACTICES). Equipment/material tables added. Modification number and information for new window seal added. Existing information for Inspection/Check replaced by a reference out to SRM. Reformatted and new headers added. |
| 56-10-31 | Window panel C (MAINTENANCE PRACTICES). Existing information for Inspection/Check replaced by a reference out to SRM. Material codes for sealants revised. NOTES on the use of sealants added. Reformatted and new headers added. |
| 56-20-11 | Passenger compartment windows (MAINTENANCE PRACTICES). Existing information for Inspection/Check replaced by a reference out to SRM. Material code for parting agent added. Material code for sealant revised. Reformatted and new headers added. |

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| Current List of Effective Pages | 1 | 1 | |
| 12-LOEP | 1 | 1 | |
| 12-CONTENTS | ALL | ALL | |
| 12-21-0 | 1 | - | |
| 12-21-00 | - | 301 | |
| 12-28 | 1 | - | |
| 12-28 | 2 | - | |
| 12-28-2 | 1 | - | |
| 12-28-2 | 2 | - | |
| 12-28-2 | 3 | - | |
| 12-28-2 | 4 | - | |
| 12-28-2 | 5 | - | |
| 12-28-2 | 6 | - | |
| 12-28-2 | 7 | - | |
| 12-28-2 | 8 | - | |
| 12-28-00 | - | 301 | |
| 12-28-00 | - | 302 | |
| 12-28-00 | - | 303 | |
| 12-28-00 | - | 304 | |
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| 12-28-00 | - | 306 | |
| 12-28-00 | - | 307 | |
| 12-28-00 | - | 308 | |
| 12-28-00 | - | 309 | |
| 12-32-00 | 301 | 301 | |
| 12-32-00 | 302 | 302 | |
| 12-32-00 | 303 | 303 | |
| 12-32-00 | 304 | 304 | |
| 12-79-0 | 1 | - | |
| 12-79-0 | 2 | - | |
| 12-79-0 | 3 | - | |
| 12-79-0 | 4 | - | |
| 12-79-00 | - | 301 | |
| 12-79-00 | - | 302 | |
| 12-79-00 | - | 303 | |
| 12-79-00 | - | 304 | |
| 21-LOEP | ALL | ALL | |
| 21-10-37 | 201 | 201 | |
| 21-10-37 | 202 | - | |
| 27-LOEP | ALL | ALL | |
| 27-CONTENTS | ALL | ALL | |
| 27-00 | 1 | - | |
| 27-00 | 201 | - | |
| 27-00 | 202 | - | |
| 27-00 | 203 | - | |
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| 27-20 | 201 | 501 | |
| 27-20 | 202 | 502 | |
| 27-20 | 203 | 503 | |

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 27-20 | 204 | 504 | |
| 27-20 | 205 | 505 | |
| 27-20 | 206 | 506 | |
| 27-20 | 207 | 507 | |
| 27-20 | 208 | 508 | |
| 27-20 | 209 | 509 | |
| 27-20 | 210 | 510 | |
| 27-20 | 211 | 511 | |
| 27-20 | 212 | 512 | |
| 27-20 | 213 | 513 | |
| 27-20 | 214 | 514 | |
| 27-20 | 215 | 515 | |
| 27-20 | 216 | - | |
| 27-20-35 | - | 401 | 27-1 |
| 27-20-35 | - | 402 | |
| 27-20-35 | - | 403 | |
| 27-20-35 | - | 404 | |
| 27-20-35 | - | 405 | |
| 27-30 | 201 | 501 | |
| 27-30 | 202 | 502 | |
| 27-30 | 203 | 503 | |
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| 27-30 | 212 | 512 | |
| 27-30 | 213 | 513 | |
| 27-30 | 214 | 514 | |
| 27-30 | 215 | 515 | |
| 27-30-30 | - | 601 | |
| 27-30-30 | - | 602 | |
| 27-50-02 | 201 | 501 | |
| 27-50-02 | 202 | 502 | |
| 27-50-02 | 203 | 503 | |
| 27-50-02 | 204 | 504 | |
| 27-50-02 | 205 | 505 | |
| 27-50-02 | 206 | 506 | |
| 27-50-02 | 207 | 507 | |
| 27-50-02 | 208 | 508 | |
| 27-50-02 | 209 | 509 | |
| 27-50-02 | 210 | 510 | |
| 27-50-02 | 211 | 511 | |
| 27-50-02 | 212 | 512 | |
| 27-50-02 | 213 | 513 | |
| 27-50-02 | 214 | 514 | |
| 27-50-02 | 215 | 515 | |
| 27-61-02 | 201 | 501 | |
| 27-61-02 | 202 | 502 | |
| 27-61-02 | 203 | 503 | |
| 27-61-02 | 204 | 504 | |
| 27-61-02 | 205 | 505 | |
| 27-61-02 | 206 | 506 | |
| 27-72 | 201 | 501 | |
| 27-72 | 202 | 502 | |
| 27-72 | 203 | 503 | |
| 27-72 | 204 | 504 | |

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 27-72 | 205 | 505 | |
| 27-72 | 206 | - | |
| 28-LOEP | ALL | ALL | |
| 28-CONTENTS | ALL | ALL | |
| 28-10-12 | 201 | 201 | |
| 28-10-12 | 202 | 202 | |
| 28-10-12 | 203 | 203 | |
| 28-10-12 | 204 | 204 | |
| 28-10-12 | 205 | 205 | |
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| 28-10-12 | 211 | 211 | |
| 28-10-12 | 212 | 212 | |
| 28-10-12 | 213 | - | |
| 28-10-12 | 214 | - | |
| 28-20-01 | 201 | 501 | |
| 28-20-01 | 202 | 502 | |
| 28-20-01 | 203 | 503 | |
| 28-20-01 | 204 | 504 | |
| 28-20-01 | 205 | 505 | |
| 28-20-01 | 206 | 506 | |
| 28-20-01 | 207 | 507 | |
| 28-20-01 | 208 | 508 | |
| 28-20-01 | 209 | 509 | |
| 28-20-01 | 210 | - | |
| 28-20-81 | 201 | 501 | |
| 28-20-81 | 202 | 502 | |
| 28-20-81 | 203 | 503 | |
| 28-20-81 | 204 | 504 | |
| 28-20-81 | 205 | 505 | |
| 28-43-41 | - | 401 | |
| 28-43-41 | - | 402 | |
| 29-LOEP | ALL | ALL | |
| 29-00-00 | 1 | 1 | |
| 29-00-00 | 2 | 2 | |
| 32-LOEP | ALL | ALL | |
| 32-CONTENTS | ALL | ALL | |
| 32-10-25 | 201 | 401 | |
| 32-10-25 | 202 | 402 | |
| 32-10-25 | 203 | 403 | |
| 32-10-25 | 204 | 404 | |
| 32-10-25 | 205 | 405 | |
| 32-10-25 | 206 | 501 | |
| 32-10-25 | 207 | 502 | |
| 32-10-25 | 208 | 503 | |
| 32-10-25 | 209 | 504 | |
| 32-10-25 | 210 | 505 | |
| 32-10-25 | 211 | 506 | |
| 32-10-25 | - | 601 | |
| 32-20-21 | 201 | 201 | |
| 32-20-21 | 202 | 202 | |
| 32-20-21 | 203 | 203 | |
| 32-20-21 | 204 | 204 | |

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 32-30-05 | - | 401 | |
| 32-30-05 | - | 402 | |
| 32-40-11 | 201 | 301 | |
| 32-40-11 | 202 | 401 | |
| 32-40-11 | 203 | 402 | |
| 32-40-11 | - | 403 | |
| 32-40-11 | - | 601 | |
| 32-40-11 | - | 701 | |
| 32-40-11 | - | 801 | |
| 32-40-21 | 201 | 301 | |
| 32-40-21 | 202 | 401 | |
| 32-40-21 | - | 402 | |
| 32-40-21 | - | 701 | |
| 32-40-21 | - | 801 | |
| 32-40-41 | 1 | 1 | |
| 32-40-41 | 2 | 2 | |
| 32-40-41 | 3 | 3 | |
| 32-40-41 | - | 4 | |
| 32-40-41 | 201 | 401 | |
| 32-40-41 | 202 | 601 | |
| 32-40-41 | 203 | 602 | |
| 32-40-41 | 204 | 603 | |
| 32-40-41 | - | 604 | |
| 32-40-41 | - | 605 | |
| 32-40-41 | - | 606 | |
| 32-40-41 | - | 607 | |
| 32-40-41 | - | 608 | |
| 32-40-41 | - | 609 | |
| 32-40-71 | - | 401 | |
| 32-40-71 | - | 402 | |
| 32-40-71 | - | 403 | |
| 32-40-71 | - | 404 | |
| 32-50 | 1 | - | |
| 32-50 | 2 | - | |
| 32-50 | 3 | - | |
| 32-50 | 501 | - | |
| 32-50 | 502 | - | |
| 32-50 | 503 | - | |
| 32-50 | 504 | - | |
| 32-50 | 505 | - | |
| 32-50-00 | - | 1 | |
| 32-50-00 | - | 2 | |
| 32-50-00 | - | 501 | |
| 32-50-00 | - | 502 | |
| 32-50-00 | - | 503 | |
| 32-50-00 | - | 504 | |
| 32-50-00 | - | 505 | |
| 32-50-00 | - | 506 | |
| 32-50-00 | - | 507 | |
| 32-50-00 | - | 508 | |
| 32-50-11 | 201 | 301 | |
| 32-50-11 | 202 | 302 | |
| 32-50-11 | - | 401 | |
| 32-50-11 | - | 402 | |
| 32-50-12 | - | 401 | |
| 32-50-12 | - | 402 | |
| 53-LOEP | 1 | 1 | |
| 53-40-01 | 201 | 201 | |
| 53-40-01 | 202 | 202 | |

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 53-40-01 | 203 | 203 | |
| 53-40-01 | 204 | - | |
| 55-LOEP | 1 | 1 | |
| 55-CONTENTS | 1 | 1 | |
| 55-13 | 201 | - | |
| 55-13 | 202 | - | |
| 55-13 | 203 | - | |
| 55-13 | 204 | - | |
| 55-13 | 205 | - | |
| 55-13-00 | - | 401 | |
| 55-13-00 | - | 402 | |
| 55-13-00 | - | 403 | |
| 55-13-00 | - | 404 | |
| 55-13-00 | - | 405 | |
| 56-LOEP | 1 | 1 | |
| 56-CONTENTS | 1 | 1 | |
| 56-10-11 | 201 | 201 | |
| 56-10-11 | 202 | 202 | |
| 56-10-11 | 203 | 203 | |
| 56-10-11 | 204 | 204 | |
| 56-10-11 | - | 205 | |
| 56-10-21 | 201 | 201 | |
| 56-10-21 | 202 | 202 | |
| 56-10-21 | 203 | 203 | |
| 56-10-21 | 204 | 204 | |
| 56-10-31 | 201 | 201 | |
| 56-10-31 | 202 | 202 | |
| 56-10-31 | 203 | 203 | |
| 56-10-31 | 204 | - | |
| 56-20-11 | 201 | 201 | |
| 56-20-11 | 202 | 202 | |
| 56-20-11 | 203 | 203 | |
| 56-20-11 | 204 | 204 | |
| 56-20-11 | 205 | - | |

## 5. TEMPORARY REVISION DATA

Record the removal of the following Temporary Revision.

TR27-1

Raytheon Aircraft Company
P.O. Box 85
Wichita
Kansas 67201
USA

DH 125 SERIES 400A (WITH MOD.252550)

(Manual Ref: MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 107

As part of the continuing manual improvement program of the Hawker/125 manuals, Raytheon Aircraft Company is issuing Chapter 20, STANDARD PRACTICES - AIRFRAME, as a separate publication, manual reference 125/H-20.
The first issue of this new manual will comprise Consumable Materials, Chapters 20-95-00, 20-95-11, 20-95-101, 20-95-201, 20-95-301, 20-95-401, 20-95-501 and 20-95-601.
Because of this change, all of the above chapters will be removed from this manual at this revision.
In future, revisions to this manual will be issued independently to the new stand alone manual.

## 1. HOLDERS OF PRINTED MANUALS

(1) Check that Revision 106 has been incorporated.

(2) Remove and destroy any pages detailed for removal as instructed in paragraph 4 of this Letter of Transmittal.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages as instructed in paragraph 4 of this Letter of Transmittal.

(4) Record the incorporation of this Revision on the new RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## 2. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove Microfilm or Microfiche at revision # 106.

(2) Insert Microfilm or Microfiche at revision # 107.

## 3. HIGHTLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| LOEP LIST | Revised |
| **Chapter 20** | |
| 20 - LOEP | Revised |
| 20 - TOC | Revised |
| 20-95-00 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-95-11 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-95-101 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-95-201 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-95-301 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-95-401 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-95-501 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |
| 20-95-601 | Deleted - covered in a separate publication issued by Raytheon Aircraft Company |

## 4.INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| LOEP LIST | 1 | 1 | |
| **Chapter 20** | | | |
| 20 - LOEP | All | All | - |
| 20 - TOC | 1, 2 and 3 | 1, 2 and 3 | - |
| 20-95-00 | All | - | - |
| 20-95-11 | All | - | - |
| 20-95-101 | All | - | - |
| 20-95-201 | All | - | - |
| 20-95-301 | All | - | - |
| 20-95-401 | All | - | - |
| 20-95-501 | All | - | - |
| 20-95-601 | All | - | - |

## 5. TEMPORARY REVISION DATA

No special instructions.

Raytheon Aircraft Company
P.O. Box 85
Wichita
Kansas 67201
USA

DH 125 SERIES 400A (WITH MOD.252550)

(Manual Ref: MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 106

## 1. HOLDERS OF PRINTED MANUALS

(1) Remove and destroy Temporary Revisions detailed for removal in paragraph 6 of this transmittal and cancel any entries for the temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

(2) Insert the revision pages in numerical sequence, removing and destroying the existing pages which are replaced by revised pages as instructed at paragraph 5.

(3) Remove and destroy pages which have been transferred to another chapter.

(4) Record the incorporation of this Revision on the new RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal and file at the front of Volume 1.

## 2. SPECIAL INSTRUCTIONS

(1) On the existing Record of Revisions (Normal) page 2, draw a diagonal line from Revision 105 to the bottom of the page, on this page write in bold lettering "DO NOT USE THIS SHEET FOR RECORDING THE INCORPORATION OF ANY FUTURE REVISIONS, USE THE NEW SHEET ISSUED BY RAYTHEON AIRCRAFT COMPANY".

(2) On the existing Record of Temporary Revisions page 1, draw a diagonal line from LOT No.7 to the bottom of the page. On this page write in bold lettering "DO NOT USE THIS SHEET FOR RECORDING THE INCORPORATION OF ANY FUTURE TEMPORARY REVISIONS, USE THE NEW SHEET ISSUED BY RAYTHEON AIRCRAFT COMPANY".

## 3. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove and destroy Temporary Revisions from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed for removal in paragraph 6 of this transmittal. Cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the binder.

## 4. HIGHLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| **Title Page Vol. 1** | Change of address and authority. |
| **Title Page Vol. 2** | Change of address and authority. |
| **Registration/ Change of address** | Change of address and authority. |
| **Current list of effected pages** | New page. |
| **Record of Revisions (NORMAL)** | Change of authority (new sheet). |
| **Record of Temporary Revisions** | Change of authority (new sheet). |
| **CHAPTER 07:** | |
| LOEP | Revised, new headers added. |
| CONTENTS | Chapter 7-10, new ATA 07-10-00. Page reissued, new headers added. |
| 07-10-00 | TR GEN 1 incorporated. Jacking and Trestling, topic revised - WARNINGS and extra information added. New headers added. |
| **CHAPTER 12:** | |
| LOEP | Revised and reformatted |
| CONTENTS | Revised, new headers added. |
| 12-00-00 | TR GEN 1 incorporated. |
| 12-30-00 | Ice and Rain protection (SERVICING), guidelines to holdover times and WARNINGS and CAUTIONS added. |
| 12-32-00 | Landing Gear (SERVICING), CAUTIONS on tire inflation added. |
| **CHAPTER 20:** | |
| LOEP | Revised, new headers added. |
| 20-95-11 | TR 20-1 incorporated. |

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 21:** | |
| LOEP | Revised, new headers added. |
| 21-30-65 | Fan Operated Venturi (MAINTENANCE PRACTICES) CAUTION added and topic reformatted. |
| **CHAPTER 27:** | |
| LOEP | Revised, new headers added. |
| CONTENTS | Revised, new headers added. |
| 27-10-00 | Aileron and Aileron Trim Control Systems (DESCRIPTION AND OPERATION) Figure 3 revised. Topic reformatted.<br>Aileron and Aileron Trim Control Systems (ADJUSTMENT/TEST). WARNING on duplicate inspection revised. |
| 27-50-151 | Flaps (MAINTENANCE PRACTICES). Installation procedure revised and topic reformatted. |
| **CHAPTER 29:** | |
| LOEP | Revised, new headers added. |
| CONTENTS | Reformatted, new headers added. |
| 29-00-00 | TR GEN 1 incorporated, WARNINGS and CAUTIONS added. |
| **CHAPTER 32:** | |
| LOEP | Revised, new headers added. |
| CONTENTS | Revised, new headers added. |
| 32-00-00 | DESCRIPTION, TR GEN 1 incorporated, new headers added.<br>MAINTENANCE PRACTICES, topic reformatted, new headers added. |
| 32-10-11 | Main Leg Assembly (MAINTENANCE PRACTICES). WARNINGS on releasing nitrogen from leg introduced. Procedure revised. |
| 32-20-12 | Nose Leg Assembly (MAINTENANCE PRACTICES). WARNINGS on releasing nitrogen from leg introduced. Procedure revised. |
| 32-30-11 | TR 32-3 incorporated. |

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 32: Cont.** | |
| 32-40-11 | Main Wheels (MAINTENANCE PRACTICES). Material item No's. introduced and topic reformatted. Note added with reference to wheels other than Dunlop. |
| 32-65-00 | Mechanical Indicating System (DESCRIPTION and OPERATION) 32-65 reissued, new ATA #.<br>Mechanical Indicating System (MAINTENANCE PRACTICES).<br>Nose gear lubrication procedure introduced. |
| **CHAPTER 34:** | |
| LOEP | Revised, new headers added. |
| **CHAPTER 56:** | |
| LOEP | Revised, new headers added. |
| 56-10-11 | Window Panel A (MAINTENANCE PRACTICES). Torque loading instructions added. |

## 5. INSTRUCTIONS FOR INCORPORATING THIS REVISION.

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| TITLE PAGE (Vol. 1) | Existing | Rev.106 | |
| TITLE PAGE (Vol. 2) | Existing | Rev.106 | |
| Registration/ Change of address | Existing | New | |
| Current List of Effected Pages | - | 1 | |
| Record of Revisions (NORM.) | NONE | 1 & 2 | |
| Record of Temporary Revisions | NONE | 1 & 2 | |
| 07-LOEP | 1 | 1 | |
| 07-CONTENTS | 1 | 1 | |
| 07-10 | 1 | - | GEN-1 |
| 07-10 | 2 | - | |
| 07-10 | 3 | - | |
| 07-10 | 4 | - | |
| 07-10 | 5 | - | |
| 07-10-00 | - | 1 | |
| 07-10-00 | - | 2 | |
| 07-10-00 | - | 3 | |
| 07-10-00 | - | 4 | |
| 07-10-00 | - | 5 | |
| 12-LOEP | 1 | 1 | |
| 12-CONTENTS | ALL | ALL | |
| 12-00 | 1 | - | GEN-1 |
| 12-00 | 2 | - | |
| 12-00 | 3 | - | |
| 12-00 | 4 | - | |
| 12-00-00 | - | 1 | |
| 12-00-00 | - | 2 | |
| 12-00-00 | - | 3 | |
| 12-00-00 | - | 4 | |
| 12-30-0 | 1 | - | |
| 12-30-0 | 2 | - | |
| 12-30-0 | 3 | - | |
| 12-30-0 | 4 | - | |
| 12-30-0 | 5 | - | |
| 12-30-0 | 6 | - | |
| 12-30-00 | - | 301 | |
| 12-30-00 | - | 302 | |
| 12-30-00 | - | 303 | |
| 12-30-00 | - | 304 | |
| 12-30-00 | - | 305 | |
| 12-30-00 | - | 306 | |
| 12-30-00 | - | 307 | |
| 12-30-00 | - | 308 | |
| 12-32-0 | 1 | - | |
| 12-32-0 | 2 | - | |
| 12-32-0 | 3 | - | |
| 12-32-0 | 4 | - | |
| 12-32-0 | 5 | - | |
| 12-32-00 | - | 301 | |
| 12-32-00 | - | 302 | |

### 5. INSTRUCTIONS FOR INCORPORATING THIS REVISION (Cont.)

| Ch-Se-Su | Remove Page | Insert Page | Remove TR | Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|---|---|---|---|
| 12-32-00 | - | 303 | | 27-10 | 207 | - | |
| 12-32-00 | - | 304 | | 27-10 | 208 | - | |
| | | | | 27-10 | 209 | - | |
| 20-LOEP | ALL | ALL | | 27-10 | 210 | - | |
| 20-95-11 | 1 | 1 | 20-1 | 27-10 | 211 | - | |
| 20-95-11 | 2 | 2 | | 27-10 | 212 | - | |
| 20-95-11 | 3 | 3 | | 27-10 | 213 | - | |
| | | | | 27-10 | 214 | - | |
| 21-LOEP | ALL | ALL | | 27-10 | 215 | - | |
| 21-30-65 | 201 | 201 | | 27-10-00 | - | 501 | |
| 21-30-65 | 202 | 202 | | 27-10-00 | - | 502 | |
| | | | | 27-10-00 | - | 503 | |
| 27-LOEP | ALL | ALL | | 27-10-00 | - | 504 | |
| 27-CONTENTS | ALL | ALL | | 27-10-00 | - | 505 | |
| 27-10 | 1 | - | | 27-10-00 | - | 506 | |
| 27-10 | 2 | - | | 27-10-00 | - | 507 | |
| 27-10 | 3 | - | | 27-10-00 | - | 508 | |
| 27-10 | 4 | - | | 27-10-00 | - | 509 | |
| 27-10 | 5 | - | | 27-10-00 | - | 510 | |
| 27-10-00 | - | 1 | | 27-10-00 | - | 511 | |
| 27-10-00 | - | 2 | | 27-10-00 | - | 512 | |
| 27-10-00 | - | 3 | | 27-10-00 | - | 513 | |
| 27-10-00 | - | 4 | | 27-10-00 | - | 514 | |
| 27-10 | 201 | - | | 27-50-151 | 201 | 201 | |
| 27-10 | 202 | - | | 27-50-151 | 202 | 202 | |
| 27-10 | 203 | - | | 27-50-151 | 203 | 203 | |
| 27-10 | 204 | - | | | | | |
| 27-10 | 205 | - | | 29-LOEP | 1 | ALL | |
| 27-10 | 206 | - | | 29-CONTENTS | ALL | ALL | |

## 5. INSTRUCTIONS FOR INCORPORATING THIS REVISION (Cont.)

| Ch-Se-Su | Remove Page | Insert Page | Remove TR | Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|---|---|---|---|
| 29-00-00 | 1 | 1 | GEN-1 | 32-20-12 | 204 | 204 | |
| 29-00-00 | 2 | 2 | | 32-20-12 | 205 | 205 | |
| | | | | 32-20-12 | 206 | 206 | |
| 32-LOEP | ALL | ALL | | 32-20-12 | - | 207 | |
| 32-CONTENTS | ALL | ALL | | 32-30-11 | 201 | 501 | 32-3 |
| 32-00 | 1 | - | GEN-1 | 32-30-11 | 202 | 502 | |
| 32-00 | 201 | - | | 32-30-11 | 203 | 503 | |
| 32-00-00 | - | 1 | | 32-30-11 | 204 | 504 | |
| 32-00-00 | - | 201 | | 32-40-11 | 201 | 201 | |
| 32-10-11 | 201 | 201 | | 32-40-11 | 202 | 202 | |
| 32-10-11 | 202 | 202 | | 32-40-11 | 203 | 203 | |
| 32-10-11 | 203 | 203 | | 32-65 | 1 | - | |
| 32-10-11 | 204 | 204 | | 32-65 | 201 | - | |
| 32-10-11 | 205 | 205 | | 32-65 | 202 | - | |
| 32-10-11 | 206 | 206 | | 32-65 | 203 | - | |
| 32-10-11 | 207 | 207 | | 32-65-00 | - | 1 | |
| 32-10-11 | 208 | 208 | | 32-65-00 | - | 201 | |
| 32-10-11 | 209 | 209 | | 32-65-00 | - | 202 | |
| 32-10-11 | 210 | 210 | | 32-65-00 | - | 203 | |
| 32-10-11 | 211 | 211 | | 32-65-00 | - | 204 | |
| 32-10-11 | 212 | 212 | | | | | |
| 32-10-11 | 213 | 213 | | 34-LOEP | ALL | ALL | |
| 32-10-11 | 214 | 214 | | | | | |
| 32-10-11 | 215 | 215 | | 56-LOEP | 1 | 1 | |
| 32-10-11 | 216 | - | | 56-10-11 | 201 | 201 | |
| 32-20-12 | 201 | 201 | | 56-10-11 | 202 | 202 | |
| 32-20-12 | 202 | 202 | | 56-10-11 | 203 | 203 | |
| 32-20-12 | 203 | 203 | | 56-10-11 | - | 204 | |

## 6. TEMPORARY REVISION DATA

Record the removal of the following Temporary Revisions.

TR GEN-1
TR 20-1
TR 32-3

Hawker
Raytheon Corporate Jets
125 AIRCRAFT MAINTENANCE MANUAL

Raytheon Corporate Jets, Inc.,
3 Bishop Square,
St. Albans Road West,
Hatfield, Hertfordshire,
AL10 9NE, England.

This permanent revision/amendment complies with British Civil Airworthiness Requirements, Section A, Chapter A5-3.

Signed ............................................................Date 12.6.95 ..........................................

CAA Approval No: DAI/2652/55

To holders of: BAe 125 Series 400A (Mod.252550) Aircraft

(Reference MM125-F400AGV1-V2)

# LETTER OF TRANSMITTAL - REVISION 105

## 1. HOLDERS OF PRINTED MANUALS

(1) Check that Revision 104 has been incorporated.

(2) Remove and destroy any pages detailed for removal on page 9 of this transmittal and cancel any entries for the temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

(3) Remove and destroy the existing pages replaced by the revised pages.

(4) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal and file at the front of Volume 1.

## 2. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove and destroy pages from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed for removal on page 9 of this transmittal. Cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the binder.

## 3. HIGHLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 09:** | |
| LOEP | Revised and reformatted. |
| 9-00 | Page block 1 deleted |
| 09-00-00 | Page block 201 added - More detailed instructions for attaching and removing towbar from aircraft. |
| **CHAPTER 12:** | |
| LOEP | Revised and reformatted |
| CONTENTS | Contents reformatted.<br>12-38-00 added |
| 12-35-3 | WARNING revised. Paragraph 1B, oxygen specification added. Chapter changed from description (block 1) to servicing (block 301). Pages reformatted. |
| 12-35-4 | WARNING revised. Paragraph 1B, oxygen specification added. Chapter changed from description (block 1) to servicing (block 301). Pages reformatted. |
| 12-38-00 | New page 301 added to check that there are no leaks in the systems. |
| **CHAPTER 20:** | |
| LOEP | Revised and reformatted. |
| CONTENTS | Revised and reformatted. |
| 20-10-33 | Revised and reformatted. |
| 20-10-5016 | Complete new chapter added |
| 20-20-645 | Removed - Replaced by 20-10-5016 |
| 20-95-00 | Completely revised and reformatted. |
| 20-95-11 | Completely revised and reformatted. |
| 20-95-101 | Completely revised and reformatted. |
| 20-95-201 | Completely revised and reformatted. |
| 20-95-301 | Completely revised and reformatted. |

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 20: (continued)** | |
| 20-95-401 | Completely revised and reformatted. |
| 20-95-501 | Completely revised and reformatted. |
| 20-95-601 | Completely revised and reformatted. |
| **CHAPTER 21:** | |
| LOEP | Revised and reformatted |
| 21-10-75 | Inspection of mass flow control valve revised. Chapter reformatted. |
| 21-10-85 | Description and operation - Information updated to show the refrigeration unit is now manufactured by Allied Signal.<br>Figure 1, now includes position of the dipstick.<br>Paragraph 3, data deleted as no longer relevent.<br>Maintenance practices - Materials/equipment added. Extra information added in paragraph 1.A.<br>Chapter reformatted. |
| 21-10-107 | Maintenance practices - Completely revised - WARNING and information added. Chapter reformatted. |
| 21-10-165 | Maintenance practices - Completely revised - WARNING and extra information added. Chapter reformatted. |
| **CHAPTER 27:** | |
| LOEP | Revised and reformatted |
| CONTENTS | 27-50-135 added to contents - contents reformatted |
| 27-50-02 | Spring strut function check added to page 215. Complete chapter reformatted. |
| 27-50-135 | New topic added for Bevel Drive Assemblies - Page block 201 |
| **CHAPTER 28:** | |
| LOEP | Revised and reformatted<br>28-10-83, page 203, date information corrected. |
| **CHAPTER 30:** | |
| LOEP | Revised and reformatted. |
| CONTENTS | New contents list produced. |

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 32:** | |
| LOEP | Revised and reformatted. |
| 32-40-31 | Page block 201 replaced by page block 401<br>Figure 401 updated to show axle with external threads. References to 'air' deleted. |
| 32-40-101 | Additional information included in troubleshooting table.<br>Test procedure also added. |
| 32-50 | Page block 201 replaced by page block 501<br>Functional test of the nose leg self centring system revised. |
| **CHAPTER 35:** | |
| LOEP | Revised and reformatted<br>35-20-42 page 203, date corrected.. |
| **CHAPTER 56:** | |
| LOEP | Revised and reformatted |
| 56-00 | Material required table added with information on silica-gel crystals.<br>Paragraph 1.C. created to include information on service filter.<br>In paragraph 2.A.(2) information concerning type of detergent and application ammended. |

**4. INSTRUCTIONS FOR INCORPORATING THIS REVISION.**

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 09-LOEP | 1 | 1 | |
| 9-00 | 1 | - | |
| 9-00 | 2 | - | |
| 9-00 | 3 | - | |
| 9-00 | 4 | - | |
| 9-00 | 5 | - | |
| 09-00-00 | - | 201 | |
| 09-00-00 | - | 202 | |
| 09-00-00 | - | 203 | |
| 09-00-00 | - | 204 | |
| 09-00-00 | - | 205 | |
| 12-LOEP | 1 | 1 | |
| 12-CONTENTS | 1 | 1 | |
| 12-CONTENTS | 2 | 2 | |
| 12-35-3 | 1 | 301 | |
| 12-35-3 | 2 | 302 | |
| 12-35-4 | 1 | 301 | |
| 12-35-4 | 2 | 302 | |
| 12-35-4 | 3 | 303 | |
| 12-38-00 | - | 301 | |
| 20-LOEP | 1 | 1 | |
| 20-LOEP | 2 | 2 | |
| 20-LOEP | 3 | 3 | |
| 20-LOEP | 4 | 4 | |
| 20-LOEP | - | 5 | |
| 20-LOEP | - | 6 | |
| 20-CONTENTS | 1 | 1 | |
| 20-CONTENTS | 2 | 2 | |
| 20-CONTENTS | - | 3 | |
| 20-10-33 | 1 | 201 | |
| 20-10-33 | 2 | 202 | |
| 20-10-33 | 3 | 203 | |
| 20-10-33 | 4 | 204 | |
| 20-10-33 | 5 | 205 | |
| 20-10-33 | 6 | 206 | |
| 20-10-33 | 7 | 207 | |
| 20-10-33 | 8 | - | |
| 20-10-33 | 9 | - | |
| 20-10-33 | 10 | - | |
| 20-10-5016 | - | 201 | |
| 20-10-5016 | - | 202 | |
| 20-10-5016 | - | 203 | |
| 20-10-5016 | - | 204 | |
| 20-10-5016 | - | 205 | |
| 20-10-5016 | - | 206 | |
| 20-10-5016 | - | 207 | |
| 20-10-5016 | - | 208 | |

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION (Cont.)

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 20-10-5016 | - | 209 | |
| 20-10-5016 | - | 210 | |
| 20-10-5016 | - | 211 | |
| 20-10-5016 | - | 212 | |
| 20-10-5016 | - | 213 | |
| 20-10-5016 | - | 214 | |
| 20-10-5016 | - | 215 | |
| 20-10-5016 | - | 216 | |
| 20-10-5016 | - | 217 | |
| 20-10-5016 | - | 218 | |
| 20-10-5016 | - | 219 | |
| 20-10-5016 | - | 220 | |
| 20-10-5016 | - | 221 | |
| 20-10-5016 | - | 222 | |
| 20-10-5016 | - | 223 | |
| 20-10-5016 | - | 224 | |
| 20-10-5016 | - | 225 | |
| 20-10-5016 | - | 226 | |
| 20-10-5016 | - | 227 | |
| 20-10-5016 | - | 228 | |
| 20-10-5016 | - | 229 | |
| 20-10-5016 | - | 230 | |
| 20-10-5016 | - | 231 | |
| | | | |
| 20-20-645 | 1 | - | |
| 20-20-645 | 2 | - | |
| 20-20-645 | 3 | - | |
| 20-20-645 | 4 | - | |
| 20-20-645 | 5 | - | |
| 20-20-645 | 6 | - | |
| 20-20-645 | 7 | - | |
| 20-20-645 | 8 | - | |
| 20-20-645 | 9 | - | |
| | | | |
| 20-95-0 | 1 | - | |
| 20-95-0 | 2 | - | |
| 20-95-0 | 3 | - | |
| 20-95-0 | 4 | - | |
| 20-95-0 | 5 | - | |
| 20-95-0 | 6 | - | |
| 20-95-0 | 7 | - | |
| 20-95-0 | 8 | - | |
| 20-95-0 | 9 | - | |
| 20-95-0 | 10 | - | |
| 20-95-0 | 11 | - | |
| 20-95-0 | 12 | - | |
| 20-95-0 | 13 | - | |
| 20-95-0 | 14 | - | |
| | | | |
| 20-95-00 | - | 1 | |
| 20-95-00 | - | 2 | |
| 20-95-00 | - | 3 | |
| 20-95-00 | - | 4 | |
| 20-95-00 | - | 5 | |
| 20-95-00 | - | 6 | |
| 20-95-00 | - | 7 | |
| 20-95-00 | - | 8 | |
| 20-95-00 | - | 9 | |

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION (Cont.)

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 20-95-00 | - | 10 | |
| 20-95-00 | - | 11 | |
| 20-95-00 | - | 12 | |
| 20-95-00 | - | 13 | |
| 20-95-00 | - | 14 | |
| 20-95-00 | - | 15 | |
| 20-95-00 | - | 16 | |
| 20-95-00 | - | 17 | |
| 20-95-00 | - | 18 | |
| | | | |
| 20-95-11 | 1 | 1 | |
| 20-95-11 | 2 | 2 | |
| 20-95-11 | 3 | 3 | |
| | | | |
| 20-95-101 | 1 | 1 | |
| 20-95-101 | 2 | 2 | |
| 20-95-101 | - | 3 | |
| 20-95-101 | - | 4 | |
| | | | |
| 20-95-201 | 1 | 1 | |
| 20-95-201 | 2 | 2 | |
| 20-95-201 | 3 | 3 | |
| 20-95-201 | - | 4 | |
| 20-95-201 | - | 5 | |
| 20-95-201 | - | 6 | |
| | | | |
| 20-95-301 | 1 | 1 | |
| 20-95-301 | 2 | 2 | |
| 20-95-301 | 3 | 3 | |
| 20-95-301 | - | 4 | |
| 20-95-301 | - | 5 | |
| 20-95-301 | - | 6 | |
| 20-95-301 | - | 7 | |
| | | | |
| 20-95-401 | 1 | 1 | |
| 20-95-401 | 2 | 2 | |
| 20-95-401 | - | 3 | |
| 20-95-401 | - | 4 | |
| 20-95-401 | - | 5 | |
| | | | |
| 20-95-501 | 1 | 1 | |
| | | | |
| 20-95-601 | 1 | 1 | |
| 20-95-601 | - | 2 | |
| 20-95-601 | - | 3 | |
| 20-95-601 | - | 4 | |
| | | | |
| 21-LOEP | 1 | 1 | |
| 21-LOEP | 2 | 2 | |
| 21-LOEP | - | 3 | |
| | | | |
| 21-10-75 | 201 | 201 | |
| 21-10-75 | 202 | 202 | |
| 21-10-75 | 203 | 203 | |
| | | | |
| 21-10-85 | 1 | 1 | |
| 21-10-85 | 2 | 2 | |
| 21-10-85 | 3 | - | |

**4. INSTRUCTIONS FOR INCORPORATING THIS REVISION (Cont.)**

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 21-10-85 | 201 | 201 | |
| 21-10-85 | 202 | 202 | |
| 21-10-85 | 203 | 203 | |
| 21-10-85 | 204 | 204 | |
| 21-10-107 | 201 | 201 | |
| 21-10-107 | - | 202 | |
| 21-10-165 | 201 | 201 | |
| 21-10-165 | - | 202 | |
| 27-LOEP | 1 | 1 | |
| 27-LOEP | 2 | 2 | |
| 27-LOEP | - | 3 | |
| 27-CONTENTS | 1 | 1 | |
| 27-CONTENTS | 2 | 2 | |
| 27-CONTENTS | - | 3 | |
| 27-50-02 | 201 | 201 | |
| 27-50-02 | 202 | 202 | |
| 27-50-02 | 203 | 203 | |
| 27-50-02 | 204 | 204 | |
| 27-50-02 | 205 | 205 | |
| 27-50-02 | 206 | 206 | |
| 27-50-02 | 207 | 207 | |
| 27-50-02 | 208 | 208 | |
| 27-50-02 | 209 | 209 | |
| 27-50-02 | 210 | 210 | |
| 27-50-02 | 211 | 211 | |
| 27-50-02 | 212 | 212 | |
| 27-50-02 | 213 | 213 | |
| 27-50-02 | 214 | 214 | |
| 27-50-02 | 215 | 215 | |
| 27-50-02 | 216 | - | |
| 27-50-135 | - | 201 | |
| 27-50-135 | - | 202 | |
| 28-LOEP | 1 | 1 | |
| 28-LOEP | 2 | 2 | |
| 28-LOEP | - | 3 | |
| 30-LOEP | 1 | 1 | |
| 30-CONTENTS | 1 | 1 | |
| 30-CONTENTS | 2 | 2 | |
| 32-LOEP | 1 | 1 | |
| 32-LOEP | 2 | 2 | |
| 32-LOEP | - | 3 | |
| 32-40-31 | 201 | 401 | |
| 32-40-31 | 202 | 402 | |
| 32-40-31 | 203 | 403 | |
| 32-40-31 | 204 | - | |
| 32-40-101 | 101 | 101 | |
| 32-40-101 | 102 | 102 | |
| 32-40-101 | - | 103 | |

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION (Cont.)

| Ch-Se-Su | Remove Page | Insert Page | Remove TR | Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|---|---|---|---|
| 32-50 | 201 | 501 | | 56-LOEP | 1 | 1 | |
| 32-50 | 202 | 502 | | | | | |
| 32-50 | 203 | 503 | | 56-00 | 201 | 201 | |
| 32-50 | 204 | 504 | | 56-00 | 202 | 202 | |
| 32-50 | 205 | 505 | | 56-00 | 203 | 203 | |
| | | | | | | | |
| 35-LOEP | 1 | 1 | | | | | |

## 5. TEMPORARY REVISION DATA

Record the removal of the following Temporary Revisions.

None

**RAYTHEON CORPORATE JETS**
**BAe 125 AIRCRAFT MAINTENANCE MANUAL**

Raytheon Corporate Jets, Inc.
3, Bishop Square,
St. Albans Road West,
Hatfield, Hertfordshire,
AL10 9NE, England.

This permanent revision/amendment complies with British Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed ...................................... Date ..17th. February..1994.........
CAA Approval No.DAI/2652/55

For holders of: BAe 125 Series 400A(Mod.252550) Aircraft

(Reference MM125-F400AGV1-V2)

## LETTER OF TRANSMITTAL FOR REVISION No.104

### 1. HOLDERS OF PRINTED MANUALS

(1) Check that Revision 103 has been incorporated.

(2) Remove and destroy any pages detailed for removal on page 4 of this transmittal and cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

### 2. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove and destroy pages from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed for removal on page 4 of this transmittal. Cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the binder.

* * *

3. HIGHLIGHTS (Instructions for incorporation see page 4 para 4).

| Ch-Se-Su | Description of change |
|---|---|
| CHAPTER 12: | |
| LOEP | Revised. |
| CONTENTS | Chapter 12-20-25 introduced. |
| 12-20-25 | Lubrication of aileron control cables introduced. |
| 12-35-3 | 'WARNINGS' and oxygen charging rig bonding added to text. |
| 12-35-4 | 'WARNINGS' and oxygen charging rig bonding added to text. |
| CHAPTER 20: | |
| LOEP | Revised. |
| 20-95-0 | U.K. and North American suppliers address changes. |
| 20-95-11 | Grease specification changes. |
| CHAPTER 21: | |
| LOEP | Typographical errors eliminated. |
| CHAPTER 25: | |
| LOEP | Typographical errors eliminated. |
| CHAPTER 26: | |
| LOEP | Revised. |
| 26-20 | Mod.253543A (Fire bottle weighing instructions revised). |
| 26-20-12 | Mod.253543A (Fire bottle weighing instructions revised). |
| 26-20-51 | Anti-recoil cap procedures added to text. |
| CHAPTER 27: | |
| LOEP | Revised. |
| 27-10 | Cross reference for lubrication to the aileron control cable added to text. |
| CHAPTER 28: | |
| LOEP | Typographical errors eliminated. |
| CHAPTER 29: | |
| LOEP | Revised. |
| 29-10-00 | 'WARNINGS' and main accumulator leak rate added to text. |
| CHAPTER 30: | |
| LOEP | Typographical errors eliminated. |

HIGHLIGHTS ... continued

| Ch-Se-Su | Description of change |
|---|---|
| CHAPTER 31: | |
| LOEP | Typographical errors eliminated. |
| CHAPTER 32: | |
| LOEP | Revised. |
| 32-10-41 | Text and drawing revised to include reference to the flanged bush in the maingear door jack attachment. |
| 32-40-41 | Text updated and partnumbers deleted. |
| CHAPTER 33: | |
| LOEP | Typographical errors eliminated. |
| CHAPTER 34: | |
| LOEP | Typographical errors eliminated. |
| CHAPTER 35: | |
| LOEP | Revised. |
| CONTENTS | Mod.253534A (pressure regulator) and new partnumber for 1400 litre oxygen bottle added. |
| 35-06 | Mod.253534A (pressure regulator with revised earthing arrangements) introduced. |

* * *

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 12-LOEP | 1 | 1 | |
| 12-CONTENTS | 1 | 1 | |
| 12-CONTENTS | 2 | 2 | |
| 12-20-25 | - | 201 | |
| 12-20-25 | - | 202 | |
| 12-35-3 | 1 | 1 | |
| 12-35-3 | 2 | 2 | |
| 12-35-4 | 1 | 1 | |
| 12-35-4 | 2 | 2 | |
| 12-35-4 | - | 3 | |
| 20-LOEP | 3 | 3 | |
| 20-LOEP | 4 | 4 | |
| 20-95-0 | 7 | 7 | |
| 20-95-0 | - | 8 | |
| 20-95-0 | 13 | 13 | |
| 20-95-0 | - | 14 | |
| 20-95-11 | 1 | 1 | |
| 20-95-11 | 2 | 2 | |
| 20-95-11 | 3 | 3 | |
| 21-LOEP | 1 | 1 | |
| 21-LOEP | 2 | 2 | |
| 25-LOEP | 1 | 1 | |
| 26-LOEP | 1 | 1 | |
| 26-20 | 1 | 1 | |
| 26-20 | 2 | 2 | |
| 26-20 | 3 | 3 | |
| 26-20 | 4 | 4 | |
| 26-20-12 | 201 | 201 | |
| 26-20-12 | 202 | 202 | |
| 26-20-12 | 203 | 203 | |
| 26-20-12 | 204 | 204 | |
| 26-20-51 | 203 | 203 | |

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 27-LOEP | 1 | 1 | |
| 27-LOEP | 2 | 2 | |
| 27-10 | 201 | 201 | |
| 27-10 | 202 | 202 | |
| 28-LOEP | 1 | 1 | |
| 28-LOEP | 2 | 2 | |
| 29-LOEP | 1 | 1 | |
| 29-10-00 | 201 | 201 | |
| 29-10-00 | 202 | 202 | |
| 29-10-00 | 203 | 203 | |
| 29-10-00 | 204 | 204 | |
| 29-10-00 | 205 | 205 | |
| 29-10-00 | 206 | 206 | |
| 29-10-00 | 207 | 207 | |
| 29-10-00 | 208 | 208 | |
| 29-10-00 | 209 | 209 | |
| 29-10-00 | - | 210 | |
| 29-10-00 | - | 211 | |
| 30-LOEP | 1 | 1 | |
| 31-LOEP | 1 | 1 | |
| 32-LOEP | 1 | 1 | |
| 32-LOEP | 2 | 2 | |
| 32-10-41 | 201 | 201 | |
| 32-10-41 | 202 | 202 | |
| 32-10-41 | 203 | 203 | |
| 32-10-41 | 204 | 204 | |
| 32-10-41 | 205 | 205 | |
| 32-10-41 | 206 | 206 | |
| 32-10-41 | - | 207 | |
| 32-40-41 | 1 | 1 | |
| 32-40-41 | 2 | 2 | |
| 32-40-41 | - | 3 | |
| 33-LOEP | 1 | 1 | |
| 34-LOEP | 1 | 1 | |

**INSTRUCTIONS FOR INCORPORATING THIS REVISION** ... continued

| Ch-Se-Su | Remove Page | Insert Page | Remove TR | Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|---|---|---|---|
| 35-LOEP | 1 | 1 | | | | | |
| 35-CONTENTS | 1 | 1 | | | | | |
| 35-CONTENTS | - | 2 | | | | | |
| 35-06 | 1 | 1 | | | | | |
| 35-06 | 2 | 2 | | | | | |

## 5. TEMPORARY REVISION DATA

Record the removal of the following Temporary Revisions:

None

The following Temporary Revisions are current at February 1994:

None

RAYTHEON CORPORATE JETS
BAe 125 SERIES AIRCRAFT MAINTENANCE MANUAL

BAe 125 Series 400A(Mod.252550) Aircraft

(Manual Ref. MM125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR REVISION No.103

Issued by
Raytheon Corporate Jets, Inc.
3, Bishop Square
St. Albans Road West,
Hatfield, Hertfordshire,
AL10 9NE, England

This permanent revision complies with British Airworthiness Requirements Section A, Chapter A5-3.

Signed............................ Date..8th September 1993

CAA Approval No. DAI/2652/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.102 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

### TITLE PAGES:

| | |
|---|---|
| V1 and V2 | Company name and address change. |

### CHAPTER 12:

| | |
|---|---|
| LOEP | Updated. |
| 12-28 | Approved fuels and additive specifications revised. |

### CHAPTER 20:

| | |
|---|---|
| LOEP | Updated and reorganised. |
| 20-10-33 | Stripping of paint revised. |
| 20-21-0 | Cross references changed. |
| 20-90-0 | Actuator limiting period added. |
| 20-95-0 | U.K. and North American suppliers addresses revised. |
| 20-95-11 | Item 46 revised. |

## CHAPTER 21:

| | |
|---|---|
| LOEP | Updated. |
| 21-10-26 | Mod.253532 (alternative HP air valve) introduced. |
| 21-60-09 | Mod.253293A (revised temperature settings) introduced. |
| 21-60-85 | Mod.253293A (revised temperature settings) introduced. |

## CHAPTER 24:

| | |
|---|---|
| LOEP | Updated. |
| 24-30-04 | Mod.253267 (additional generator control arrangements) introduced. |

## CHAPTER 26:

| | |
|---|---|
| LOEP | Updated. |
| 26-10-41 | HP air duct detector switch added. |
| 26-20 | Caution added to specify test set requirements. |

## CHAPTER 27:

| | |
|---|---|
| LOEP | Updated. |
| 27-20 | Full range of movement check for rudder pedal assemblies added. |

## CHAPTER 28:

| | |
|---|---|
| LOEP | Updated. |
| 28-00-01 | Fuel system safety precautions introduced. |

## CHAPTER 29:

| | |
|---|---|
| LOEP | Updated. |
| 29-10-00 | Mod.253531A (NYAB pump hydraulic couplings) introduced. Warning added for test rig/fluid compatibility. Chapter references added. |

## CHAPTER 30:

| | |
|---|---|
| LOEP | Updated. |
| 30-44 | Windshield fluid de-icing system maintenance practices revised. |

## CHAPTER 32:

| | |
|---|---|
| LOEP | Revised and updated. |
| 32-40-51 | Cross references defined. |
| 32-50 | Steering description and operation revised. |

CHAPTER 52:

| | |
|---|---|
| LOEP | Page reorganised and updated. |
| 52-11 | Warnings added for tensator motor/entry door servicing. Chapter references revised. |
| 52-11-11 | Warnings and cautions added for tensator motor servicing. Chapter references revised. |

BRITISH AEROSPACE
BAe 125 AIRCRAFT MAINTENANCE MANUAL

BAe 125 Series 400A(Mod.252550) Aircraft

(Manual Ref. MM125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR REVISION No.102

Issued by
Corporate Jets Limited,
St. Albans Road West,
Hatfield, Hertfordshire,
AL10 9NE, England

This permanent revision/amendment complies with Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed.................... Date..25 MARCH 1993
CAA Approval No. DAI/2652/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.101 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

| | | |
|---|---|---|
| CHAPTER 27: | LOEP | Pages reorganised. |
| | 27-20-23 | Rudder secondary stop adjustments revised. |

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BRITISH AEROSPACE
BAe 125 SERIES AIRCRAFT MAINTENANCE MANUAL (VOLS.1 AND 2)

BAe 125 Series 400A(Mod.252550) Aircraft

(Manual Ref.MM125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR REVISION No.101

Issued by
Corporate Jets Limited,
St. Albans Road West,
Hatfield, Hertfordshire,
AL10 9NE, England

This permanent revision complies with British Airworthiness Requirements Section A, Chapter A5-3.

Signed.......................  Date.23 FEBRUARY 1993

CAA Approval No. DAI/2652/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.100 has been incorporated.

(2) Remove and destroy the following pages :
TR No.24-2, cancel the entry in the RECORD OF TEMPORARY REVISIONS.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

| | | |
|---|---|---|
| TITLE PAGES: | V1 and V2 | Pages revised and updated. |
| CHAPTER 20: | LOEP | Pages reorganised. |
| | CONTENTS | New topics 20-10-31 and 20-10-32 added. |
| | 20-10-31 | Control cables - maintenance practices introduced. |
| | 20-10-32 | Control cables - corrosion protection introduced. |
| | 20-10-33 | Paint remover Dasic 23 added. |
| | 20-95-0 | Dasic International address added. |
| | 20-95-201 | Dasic 23 added. |
| CHAPTER 21: | LOEP | Pages reorganised. |
| | 21-10-95 | Increased torque loading for water separator clamp support added. |

| | | |
|---|---|---|
| CHAPTER 24: | LOEP | Pages reorganised. |
| | CONTENTS | New topic 24-30-103 added. |
| | 24-01 | Caution added for the removal of transportation blanks and covers. |
| | 24-30-21 | Introduction of Mod.253267 and Mod.259948. TR24-2 incorporated into text. |
| | 24-30-103 | Description and operation for Hawker type battery. |
| CHAPTER 26: | LOEP | Pages reorganised. |
| | 26-20 | Introduction of tests to establish diode unserviceability. |
| CHAPTER 27: | LOEP | Pages reorganised. |
| | 27-00 | Note added for control cable examination. |
| | 27-20 | Rudder secondary stops adjustment added. |
| | 27-20-23 | Note added for secondary stops adjustment. |
| CHAPTER 28: | LOEP | Pages reorganised. |
| | 28-09-11 | Topic revised to clarify 'O' ring seal changes. |
| | 28-20-01 | Note added for control cable examination. |
| | 28-20-12 | Notes added to highlight interchangeability of booster pumps. |
| CHAPTER 29: | LOEP | Page reorganised. |
| | CONTENTS | New topic 29-10-54 added. |
| | 29-10-54 | Introduction of Abex EDP maintenance practices. |
| CHAPTER 30: | LOEP | Page reorganised. |
| CHAPTER 32: | LOEP | Pages reorganised. |
| | 32-20 | Installation of nose landing gear strut clarified. |
| | 32-20-21 | Installation of nose landing gear strut clarified. |
| | 32-40 | Introduction of brake drag checks. |
| | 32-40-51 | Introduction of brake drag checks. |
| | 32-50 | Steering system friction check added. |
| CHAPTER 33: | LOEP | Page reorganised. |
| CHAPTER 51: | LOEP | Page reorganised. |
| | 51-00 | Use of inclinometer on rigging boards clarified. |
| CHAPTER 57: | LOEP | Page reorganised. |
| | 57-20 | Alternative cleaner added to text. |

# BRITISH AEROSPACE
# BAe 125 SERIES AIRCRAFT MAINTENANCE MANUAL (VOLS.1 AND 2)

BAe 125 Series 400A(Mod.252550) Aircraft

(Manual Ref.MM125-F400AGV1-V2)

## LETTER OF TRANSMITTAL

## FOR REVISION No.100

Issued by
British Aerospace
Regional Aircraft Limited
Comet Way, Hatfield, Hertfordshire,
AL10 9TL, England.

This permanent revision complies with British Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed..Cuzens........... Date 14.4.92........
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision 99 has been incorporated.

(2) Remove and destroy the following pages :
TR No.26-1 and TR No.26-2, cancel entry in RECORD OF TEMPORARY REVISIONS.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages.

(4) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

| | | |
|---|---|---|
| CHAPTER 20: | LOEP | Pages reorganised. |
| | CONTENTS | New topics 20-10-312 and 20-10-4012 added. |
| | 20-10-312 | Bonding with 3M EC1300L |
| | 20-10-4012 | Bonding with Bostik 2402. |
| | 20-95-301 | Items 338 and 339 added. |
| CHAPTER 21: | LOEP | Page 1 revised. |
| | 21-10-26 | Illustration revised. |
| CHAPTER 24: | LOEP | Pages reissued. |
| | 24-30-04 | Text revised to incorporate Mod.253267. |

## HIGHLIGHTS (continued)

| | | |
|---|---|---|
| CHAPTER 26: | LOEP | Pages reorganised. |
| | 26-20 | TR26-1 incorporated into text. |
| | 26-20-12 | TR26-2 incorporated into text. |
| CHAPTER 27: | LOEP | Pages reorganised. |
| | 27-20-23 | Topic revised to incorporate shimming of rudder on assembly. |
| CHAPTER 28: | LOEP | Pages reorganised. |
| | CONTENTS | New topics 28-20-21 and 28-20-201 added. |
| | 28-20-01 | Illustration revised. |
| | 28-20-21 | Non-return valves - Maintenance Practices. |
| | 28-20-201 | Fuel suction pipe and strainer - Maintenance Practices. |
| CHAPTER 30: | LOEP | Page 1 revised. |
| | 30-10-71 | CAUTION added for adjustment or replacement of distribution panels. |
| CHAPTER 34: | LOEP | Page 1 revised. |
| | 34-14-0 | Topic revised to incorporate correct tolerance figures. |
| CHAPTER 53: | LOEP | Page 1 revised. |
| | 53-40-01 | Topic revised to remove reference to ventral tank removal. |
| CHAPTER 57: | LOEP | Page revised. |
| | CONTENTS | New topic 57-20 added. |
| | 57-20 | Wing to fuselage fairing seal - Maintenance Practices. |

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BRITISH AEROSPACE
BAe 125 SERIES AIRCRAFT MAINTENANCE MANUAL (VOLS.1 AND 2)

BAe 125 Series 400A(Mod.252550) Aircraft

(Manual Ref.MM125-F400AGV1-V2)

# LETTER OF TRANSMITTAL

## FOR REVISION No.99

Issued by
British Aerospace
(Commercial Aircraft) Limited
Airlines Division
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed.............................. Date.9.4.1991......
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision 98 has been incorporated.

(2) Remove and destroy the following pages :
TR No. 32-2, cancel entry in RECORD OF TEMPORARY REVISIONS.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages.

(4) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

| | | |
|---|---|---|
| CHAPTER 12: | 12-28 | JP-5 type fuel added, new fuel spec. chart included. |
| CHAPTER 20: | LOEP | Pages reorganised. |
| | 20-10-33 | CAUTION added to clarify paint stripping methods. |
| | 20-95-0 | Page 1 date added. |
| | 20-95-0 | Page 13 AKZO address added.. |
| | 20-95-401 | Item 469 added. |
| CHAPTER 24: | LOEP | Pages reissued. |
| | 24-30-21 | Text revised to comply with ISB 24-A278. |
| CHAPTER 27: | LOEP | Pages reorganised. |
| | 27-10-31 | Caution revised. |
| | 27-20-23 | Caution revised. |
| | 27-30-22 | Caution revised. |
| CHAPTER 28: | LOEP | Pages reorganised. |
| | 28-20-01 | Garrett Report No. altered. |
| | 28-20-08 | Garrett Report No. altered. |
| CHAPTER 29: | 29-10-00 | Reference to charging accumulators with air removed, accumulators now charged with nitrogen ONLY. |
| | 29-10-53 | Approved method of fitting suppressor adapter and clamping bracket added. |
| | 29-10-81 | Reference to charging accumulators with air removed, accumulators now charged with nitrogen ONLY. |
| CHAPTER 30: | 30-41 | Test revised to include method of testing without use of test set HSA 25YTS31E-5A. |
| CHAPTER 32: | 32-10-11 | TR 32-2 incorporated into text. |

* * *

BRITISH AEROSPACE
BAe 125 AIRCRAFT MAINTENANCE MANUAL (VOLS.1 AND 2)

Series 400A (with Mod.252550)

(Reference MM125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR
# REVISION NO.98

Issued by
British Aerospace
(Commercial Aircraft) Limited
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed. RS Cousens ................ Date 9th November 1989
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision 97 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the Record of REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

| | |
|---|---|
| CHAPTER 7: | 7-10 Instructions for wing/fuselage maintenance practices transferred to Chapter 53. |
| CHAPTER 12: | 12-29-0 Specification of Hydraulic fluid updated.<br>12-79-0 General update of approved engine oils. |

BRITISH AEROSPACE
BAe 125 AIRCRAFT MAINTENANCE MANUAL (VOLS.1 AND 2)

Series 400A (with Mod.252550)

(Reference MM125-F400AGV1-V2)

Letter of Transmittal No.98 continued ...

## HIGHLIGHTS

CHAPTER 20: 20-95-101 Specification of Hydraulic fluid updated.

CHAPTER 24: 24-30-104 Examine battery connectors.

CHAPTER 27: 27-20 Break-out figure revised.
27-61-21 Split pins added.

CHAPTER 29: 29-10-00 Specification of Hydraulic fluid updated.
Trouble shooting para.3(c) added.
System decay time revised.
29-10-53 Mod. 253202A added.

CHAPTER 53: 53-40-01 Wing/Fuselage fittings MP included

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# BRITISH AEROSPACE
# BAe 125 AIRCRAFT MAINTENANCE MANUAL (VOLS.1 AND 2)

Series 400A (with Mod.252550)

(Reference MM125-F400AGV1-V2)

## LETTER OF TRANSMITTAL
## FOR
## REVISION NO.97

Issued by
British Aerospace
(Commercial Aircraft) Limited
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements Section A, Chapter A6-2.

Signed.............................. Date 10th May 1989
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision 96 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the Record of REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

**CHAPTER 26** : Fire detection and warning maintenance practices revised.

**CHAPTER 30** : Windshield ice and rain protection description and operation revised.

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# BRITISH AEROSPACE
# BAe 125 AIRCRAFT MAINTENANCE MANUAL (VOLS.1 AND 2)

Series 400A (with Mod.252550) Aircraft

(Reference MM125-F400AGV1-V2)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.96

Issued by
British Aerospace Public Limited Company
Civil Aircraft Division
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements Section A, Chapter A6-2.

Signed.................................. Date......28 July 1988......
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision 95 has been incorporated.

(2) Remove and destroy the following pages :

TR 12-1 and TR Intro-1, cancel entries on the Record of Temporary Revisions

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the Record of REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

Printed in England

...Letter of Transmittal No.96 continued...

## HIGHLIGHTS

INTRODUCTION: Manual title pages revised, cancelling TR Intro-1

CHAPTER 10 : Parking and mooring data revised

CHAPTER 12 : Landing gear servicing data revised to introduce the use of nitrogen only when inflating tyres, cancelling TR 12-1

CHAPTER 24 : D.C. generation, maintenance practices revised to include additional check on split busbar system.

CHAPTER 27 : Aileron horn to wing tip navigation lamp cover, min. clearance added.
Flap screwjack servicing procedure revised.

CHAPTER 28 : Data on Avimo pipe couplings revised.

* * *

# HS 125 MAINTENANCE MANUAL (VOLS.1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

## LETTER OF TRANSMITTAL
## FOR
## REVISION NO.95

Issued by
British Aerospace PLC
Civil Aircraft Division
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed.................. Date.11th June 1987............
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.94 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 20 : Alternative leak testing solution included.

CHAPTER 21 : Mixing valve maintenance practices revised.
Data on mixing valve reference regulator and temperature compensator included.

CHAPTER 24 : Data revised on random frequency windshield power system, to include Mod.252886.

HS 125 MAINTENANCE MANUAL (VOLS.1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

...Letter of Transmittal for Revision No.95 continued

HIGHLIGHTS continued

CHAPTER 30 : TKS de-icing pump maintenance practices revised.

CHAPTER 32 : Maintenance procedure for changing equi-flex scraper ring deleted, applicable data in previous paragraph.
Main gear door maintenance practices revised to include location of flanged bush in forward hinge.

CHAPTER 33 : Data on anti-collision beacon revised.

CHAPTER 35 : Automatic shut-off valve, maintenance practices revised.

* * *

# HS 125 MAINTENANCE MANUAL (VOLS 1 and 2)

## SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

## ERRATUM

## TO

## REVISION No.94

Issued by
British Aerospace Public Limited Company
Civil Aircraft Division
Hatfield, Hertfordshire, England.

1. Remove and destroy Effective pages-28, page 1 and 2 supplied with Revision No.94 and substitute new pages attached.
2. Remove and destroy Effective pages-34, page 1 supplied with Revision No.94 and substitute new page attached.

NOTE : Correct pages bear the reference (F400A) adjacent to the page date.

* * *

HS 125 MAINTENANCE MANUAL (VOLS 1 and 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL FOR REVISION No.94

Issued by
British Aerospace Public Limited Company
Civil Aircraft Division
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .................... Date 3rd. November. 1986....
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.93 has been incorporated.

(2) Remove and destroy the following pages:

28-10-91, pages 201, 202 and 203
Chapter 32, Table of Contents, page 3
32-10-23, pages 201 to 209.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 20: Krytox 240 anti-seize compound introduced in lieu of Rectorseal.

CHAPTER 24: DC Generation, maintenance practices revised, data on brush wear check revised.

...Letter of Transmittal for Revision No.94 continued

## HIGHLIGHTS continued

CHAPTER 27: Flap rigging data revised.

CHAPTER 28: Data revised due to removal of all Strontium Chromate from aircraft (Mod.252990). Table of Contents revised to remove all part numbers.

CHAPTER 29: Caution introduced against use of Trichloroethylene for cleaning of hydraulic systems.

CHAPTER 30: Data revised due to removal of all Strontium Chromate from aircraft.

CHAPTER 32: Sidestay rigging data revised, 32-10-25 replaces 32-10-23. Table of Contents revised to delete all part numbers.

CHAPTER 34: Data revised in Stall Warning System, Maintenance Practices.

CHAPTER 53: Data revised due to removal of all Strontium Chromate from aircraft.

HS 125 MAINTENANCE MANUAL (VOLS 1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.93

Issued by
British Aerospace Public Limited Company
Civil Aircraft Division
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .................................. Date 31st January 1986

CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.92 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 29 : General Removal/Installation Maintenance Practices added.

Engine-driven hydraulic pump Maintenance Practices completely revised.

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HS 125 MAINTENANCE MANUAL (VOLS 1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.92

Issued by
British Aerospace Public Limited Company
Aircraft Group: Civil Division
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .............................. Date 12th May 1984

CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.91 has been incorporated.

(2) Remove and destroy the following pages:
Temporary Revision No.32-1 in 32-10-23 and cancel the entry on the RECORD OF TEMPORARY REVISIONS.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 32 : Incorporation of Temporary Revision covering revised adjustment instructions for main gear sidestay eccentric bolts and reversing valve mechanism.

* * *

# DH 125 MAINTENANCE MANUAL (VOLS 1 AND 2)

## SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.91

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Division
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed ...................................... Date 23rd December 1983 ......................................

CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.90 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 12: Ice and rain protection - warning regarding effective period of de-icing fluid following application to standing aircraft.

CHAPTER 24: Starter/generator brush replacement data incorporated.

SAFT main battery - capacity test procedure revised and transferred to an Inspection/Check item.

CHAPTER 28: Fuel contents system Mod.252858 incorporated (cable MCK-A-45 superseded by MCK-B-45).

...Letter of Transmittal for Revision No.91 continued

HIGHLIGHTS continued

CHAPTER 29: Maintenance practices for main system accumulator added.

Mod.252872 incorporated (additional non-return valve in reservoir pressurizing connection).

Pressure filter cleaning data revised and manufacturer's requirement for pressure drop check following cleaning procedure. In view of specialist equipment required, it is recommended that non-disposable element be returned to manufacturer or suitable repair agency for cleaning. S.E.R. No.158 also refers.

CHAPTER 32: Mod.257619 incorporated (longer life nosewheel tyre) and caution added stating tyres to this Mod. standard must not be paired with a tyre of any other part number.

Anti-corrosive sealing procedure for modulator unit retaining nut threads added and correct installation of Maxaret coupling seals illustrated.

CHAPTER 56: Window panel A - note added regarding edge delamination. Bolting arrangement revised to call for washers at specified bolt positions to spread clamping force.

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# DH 125 MAINTENANCE MANUAL (VOLS 1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.90

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Division
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed ................................ Date 29th July, 1983

CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.89 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

**INTRODUCTION** : Maintenance procedures revised to include disconnection of electrical power.

**CHAPTER 35** : Disconnection of electrical power required when removing/installing oxygen cylinders.

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PRINTED IN ENGLAND

DH 125 MAINTENANCE MANUAL (VOLS. 1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.89

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Division,
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .................................. Date 30th December 1982

CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.88 has been incorporated.

(2) Remove and destroy the following pages :-

24-30-02 )
24-30-112 ) complete subjects

Temporary Revision No.24-1 facing 24-30-21, page 206 (cancelled by Rev.85).

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 20 : Paint stripping specification updated.

CHAPTER 24 : DC Generation subject incorporating cold start facility and third battery deleted.

Additional torque loading data incorporated.

...Letter of Transmittal for Rev. No.89 continued

## HIGHLIGHTS continued

| | |
|---|---|
| CHAPTER 24 (contd) | AC generator Maintenance Practices expanded to include Unit Servicing subject covering lubrication of drive end bearing.<br>APU generation system functional test corrected. |
| CHAPTER 27 : | Functional test of elevator trim control system revised - positioning of elevator trim pointer corrected due to new trim label fitted on engine retrofit.<br>Flap screwjack and reduction gearbox Removal/Installation revised to call for retention of thrust washers from removed screwjack and for the screwjack nut housing to be set 1/4 turn up from end stop (was 1 1/8 to 1 1/2 turns) on jack installation. |
| CHAPTER 29 | Engine-driven hydraulic pump Maintenance Practices revised to incorporate inspection procedure for drive coupling splines. |
| CHAPTER 30 : | Trouble shooting data for airframe de-icing system expanded to cover the fault of no flow at distributors after partial disassembly or after running fluid tank dry. |
| CHAPTER 53 : | Revised test figures for outward opening door tensator motor to Mod.252582 standard. |

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# DH 125 MAINTENANCE MANUAL (VOLS.1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.88

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Divison
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed ................................ Date 30th April, 1982

CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.87 has been incorporated.

(2) Remove and destroy the following page :-
24-35-03, Page 7.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of transmittal.

## HIGHLIGHTS

**CHAPTER 10** : Danger areas illustration revised.

**CHAPTER 12** : List of approved fuels expanded to include JP4 wide - cut fuel (Mod. 25/2738 on both engines).

**CHAPTER 24** : Electrical connections torque loading data revised.
Mod.252790 (removal of G.C.U. fault sensing and test circuits) incorporated.
Note added regarding fouling of starter/generator clamps and clips upon closing of bottom cowling.

...Letter of Transmittal Rev.No.88 continued

**CHAPTER 27** : Rudder bias system diagram revised to state indicator transferred to MWS panel when Mod.252843 incorporated.

**CHAPTER 29** : Correction to main system test using aircraft engines.

**CHAPTER 30** : The CAUTION : NEVER USE WIRE TO CLEAR A METERING TUBE deleted from Airframe De-icing System trouble shooting data.

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DH 125 MAINTENANCE MANUAL (VOLS.1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.87

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Division
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed ................................ Date 30th November 1981
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.86 has been incorporated.

(2) Remove and destroy the following pages :-
28-20-51, Pages 1, 201-202

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 20 : Process Specs.S26.3512 and SL 1040 and American equivalents for adhesives, jointing and sealing compounds updated.

CHAPTER 21 : Air supply system schematic diagram revised to incorporate HP air valve low pressure switch.
Water separator installation procedure revised to call attention to correct positioning of drain and separator body.

CHAPTER 26 : Details of Graviner fire/overheat detector switches introduced by Mod.25/2793 added.

...Letter of Transmittal for Revision No.87 continued

HIGHLIGHTS continued

| | |
|---|---|
| CHAPTER 27 : | Rudder bias system descriptive data - Note added regarding rudder bias struts introduced by Mods.25/2762 and 25/2829.<br>Adjustment/Test subject added to flaps Maintenance Practices to detail flap shroud adjustment procedure previously referenced in Check/Tests after installation which has now been deleted. |
| CHAPTER 28 : | Fuel contents indicating (capacitance) system Maintenance Practices revised to incorporate Mods.25/2763 and 25/2812 and to call for torque loading of tank terminal MB 54 special nut to 25 lbf.in. on installation. |
| CHAPTER 30 : | TKS pipeline coupling Maintenance Practices revised to Mod.25/2559 standard. |
| CHAPTER 32 : | Incorporation of Microfiltrex filters in landing gear hydraulic 'up' lines (Mod.25/2837). |
| CHAPTER 34 : | Pitot/static drain valve illustrated and schematically located. |
| CHAPTER 56 : | Window panel Maintenance Practice revised to call up white spirit to Spec. BS 245 as a Thiokol cleaner; other cleaners can cause crazing. |

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# DH 125 MAINTENANCE MANUAL (VOLS. 1 AND 2)

SERIES 400A AIRCRAFT (with Mod.252550)

(Reference MM 125-F400AGV1-V2)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.86

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Division
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed ................................ Date 31st July 1981
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.85 has been incorporated.

(2) Remove and destroy Volume 1 and 2 title pages and insert revised title pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(4) Retain this Letter of Transmittal.

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PRINTED IN ENGLAND

# DH 125 MAINTENANCE MANUAL (VOLS. 1 AND 2)

## SERIES 400A (with Mod.252550) AIRCRAFT

(Reference MM 125-F400AGV1-V2)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.85

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Division
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .................... Date 19th May, 1981
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.84 has been incorporated.

(2) Remove and destroy the following pages :-

32-40-41, pages 205 to 210.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

**GENERAL** LUBRICATION

Lubricants referenced in Maintenance Practices have been updated where necessary to the current DTD Specification. Details of obsolete lubricants cancelled by this revision are :-

Grease DTD 900/4609, superseded by DTD 5609
Grease DTD 844 and 866, superseded by DTD 5598
Grease DTD 878A, superseded by DTD 5601
Grease DTD 900/4841, superseded by DTD 5601
Oil DTD 900/4205, superseded by DTD 5578
Anti-seize compound DTD 5530, superseded by DTD 5617.

PRINTED IN ENGLAND

DH 125 MAINTENANCE MANUAL (VOLS.1 AND 2)

SERIES 400A (with Mod.252550) AIRCRAFT

...Letter of Transmittal for Revision No.85 continued

HIGHLIGHTS continued

INTRODUCTION : MAINTENANCE PROCEDURES instruction revised to include additional requirement :-

> "Ensure that any damage to structure or safety - critical component parts caused during maintenance operations is reported to the local airworthiness authority and/or the aircraft manufacturer."

CHAPTER 12: Kilfrost ABC (all temperatures) fluid supersedes previously listed fluids for de-icing standing aircraft.
TKS W.W.F. Mod.11 washing fluid supersedes Kilfrost H63A fluid for windshield de-icing.

CHAPTER 20: Update of greases and lubricants, fluids and oils American equivalents and cleaning agents.

CHAPTER 21: In-situ performance check for flow control valve incorporated.

CHAPTER 27 : Aileron maintenance practices revised to allow retouching or painting over existing paint providing aileron balance is rechecked and adjusted as necessary.

CHAPTER 28 : Nonidet LE detergent supersedes Lensodel A for removal of microbiological debris deposits.

CHAPTER 29 : Revised procedure for cleansing hydraulic system of contamination following failure of engine-driven pump.
Inclusion of inspection procedure following day running of pumps.

CHAPTER 32 : Mod.25/2498 (landing gear selector lever "out of down" position warning) incorporated.
Removal/Installation instructions for main leg revised.
Lubrication changes.
Landing gear selector controls Maintenance Practices revised.
Brake unit Maintenance Practices revised to align with Dunlop overhaul manual.
Illustration of nose wheel steering system revised to depict correct installation of hydraulic filter - longer plain portion of filter body facing toward nose of aircraft.

CHAPTER 56 : Lubrication changes.

* * *

DH 125 MAINTENANCE MANUAL (VOLS. 1 AND 2)

SERIES 400A (with Mod.252550) AIRCRAFT

(Reference MM 125-F400AGV1-V2)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.84

Issued by
British Aerospace Public Limited Company
Aircraft Group: Hatfield-Chester Division
Hatfield, Hertfordshire, England.

PRINTED IN ENGLAND

**This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.**

Signed .................................. Date 28th January, 1981
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.83 has been incorporated.

(2) Remove and destroy the following pages :-

20-10-1011, pages 1 to 12.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

| | |
|---|---|
| CHAPTER 20 | Specification DHS 645 revised to delete reference to tyre conductivity. Process Spec. S26-1011 is not applicable and is therefore deleted. |
| CHAPTER 21 | Mobil Jet II added to list of approved oils for refrigeration unit. |
| CHAPTER 24 | Reference to tyre conductivity deleted from list of bonding requirements. |

DH 125 MAINTENANCE MANUAL (VOLS. 1 AND 2)

SERIES 400A (with Mod.252550) AIRCRAFT

...Letter of Transmittal for Revision No. 84 continued

HIGHLIGHTS continued

| | |
|---|---|
| CHAPTER 24 contd. | Starter/generator Maintenance Practices revised to incorporate details of cable removal and installation to obviate fouls on engine pod structure. |
| CHAPTER 29 | Engine-driven pump Maintenances Practices revised to incorporate Mod.252764 (improved locknut at ripple suppressor connection). Pump installation details revised.<br>Pressure filter Maintenance practices revised to incorporate Mod.257581 - disposable filter element. |

* * *

**Raytheon Aircraft**

125 AIRCRAFT MAINTENANCE MANUAL

## CURRENT LOEP DATES AT REVISION No. 112

| CHAPTER | DATE LAST REVISED |
|---|---|
| Chapter 05 | Sept.78 (GY) |
| Chapter 06 | Sept.78 (GY) |
| Chapter 07 | Sept.98 |
| Chapter 08 | Sept.78 (GY) |
| Chapter 09 | May 95 |
| Chapter 10 | June 1/88 (F400A/B) |
| Chapter 12 | Dec.99 |
| Chapter 20 | Jun.03 |
| Chapter 21 | Dec.99 |
| Chapter 22 | Sept.78 (GY) |
| Chapter 23 | Sept.78 (GY) |
| Chapter 24 | Aug.93(F400A) |
| Chapter 25 | Feb.94(F400A) |
| Chapter 26 | Feb.94(F400A) |
| Chapter 27 | Dec.99 |
| Chapter 28 | Dec.99 |
| Chapter 29 | Dec.99 |
| Chapter 30 | May 95 |
| Chapter 31 | Feb.94(F400A) |
| Chapter 32 | Jun.03 |
| Chapter 33 | Feb.94(F400A) |
| Chapter 34 | Sept.98 |
| Chapter 35 | May 95 |

| CHAPTER | DATE LAST REVISED |
|---|---|
| Chapter 38 | Sept.78 (GY) |
| Chapter 49 | Sept.78 (GY) |
| Chapter 51 | Feb.93(F400) |
| Chapter 52 | July 93(F400) |
| Chapter 53 | Dec.99 |
| Chapter 55 | Dec.99 |
| Chapter 56 | Dec.99 |
| Chapter 57 | Feb.93(F400) |

EFFECTIVITY: F400A

***To get true value from this manual it is important that you***

## Look Overleaf...

**CAUTION: THIS MANUAL REPLACES THE ONE SUPPLIED INITIALLY FOR THE AIRPLANE WITH VIPER ENGINES. IT IS IMPORTANT TO KEEP ANY DATA ISSUED FROM A SOURCE OTHER THAN RAYTHEON AIRCRAFT COMPANY (BAe, HSA) TO COVER ANY CHANGES MADE AFTER DELIVERY OF THE AIRPLANE IN ITS ORIGINAL FORM. ANY REVISIONS INSERTED IN THE ORIGINAL MANUAL, OTHER THAN THOSE ISSUED BY THE MANUFACTURERS, MUST ALSO BE TRANSFERRED TO THIS MANUAL.**

## 1. Information

### A. Manual

The 125 Aircraft Maintenance Manual is prepared in accordance with the requirements of ATA (Air Transport Association of America) Specification 100 with respect to the arrangement and content of the System/Chapters within the designated numbering system.

This maintenance manual is supplemented by various other publications. For information on the other publications visit the web site at: http://www.raytheonaircraft.com/support/pubs/publications.asp.

After the initial airplane warranty period, neither reissues nor revisions are automatically provided to the holder of this manual. For information on how to get reissues or revisions applicable to this manual, refer to the latest revision of the Raytheon Aircraft Company Service Bulletin No. 00-2001 or visit the web site at: http://www.raytheonaircraft.com/support/pubs/publications.asp.

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### B. Compact disk (CD-ROM)

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## 2. Introduction

### A. Content

The manual consists of 3 volumes. Volumes 1 and 2 are related to the airframe, and volume 3 which contains all the power plant chapters, is related to the engine type; this enables operators to be provided with a manual covering their particular airframe/engine combination.

The manual contains descriptive information on the airframe systems and items of equipment to the level required to service the airplane, to understand and troubleshoot the systems, and to remove and install the units where this is not self-evident.

Where vendor items are not fully described in the manual, reference to the descriptive data in associated vendor manuals is facilitated by the component part number being given in some Chapters. These part numbers must not be used to order spares, an Illustrated Parts Catalog is supplied for that purpose.

For information concerning servicing, storage, shelf life, transportation etc. of vendor components, refer to the relevant vendor publication.

Maintenance manuals for radio equipment, flight systems and autopilots are supplied separately. Reference to these separate manuals is given where necessary in the text of this manual.

This airplane is referred to in this manual as the DH. 125 or the HS. 125; this is due to the airplane being known as the DH. 125 at the time of the initial compilation of the manual, regardless of the existing variation in the reference all information in this manual is applicable to both of the variants.

## B. Chapterization

Chapters are numbered in accordance with ATA Specification No.100, and give a functional breakdown of all the airplane. Information on all units which make a system will be found in the chapter identified by the name of that system. For example, all units which relate to the generation and distribution of electrical power are included in Chapter 24, ELECTRICAL POWER, but the electrically-driven fuel booster pumps are included in Chapter 28, FUEL.

## C. Chapter breakdown

Each chapter is divided into sections and each section into subjects. These three elements (chapter - section - subject) are given numbers as described in *Subject numbers.* The breakdown of any chapter is shown by the related Table of Contents.

## D. Subject numbers

A three-element subject numbering system is used throughout the manual. An example follows:

28-10-41

| Chapter: | Section: | Subject: |
|---|---|---|
| System: | Sub-system: | Unit |
| FUEL | STORAGE | FILLER CAP ASSEMBLY |

## E. Page numbers

Pages are numbered consecutively within each subject. Blocks of page numbers are given for different subject topics as follows:

| | |
|---|---|
| Page 1 to 99 | Description and Operation |
| Page 101 to 199 | Troubleshooting |
| Page 201 to 299 | Maintenance Practices |

Should a maintenance practice be extensive, the individual procedures are given the page number blocks that follow:

| | | | |
|---|---|---|---|
| 301 to 399 | Servicing | 601 to 699 | Inspection/Check |
| 401 to 499 | Removal/Installation | 701 to 799 | Cleaning/Painting |
| 501 to 599 | Adjustment/Test | 801 to 899 | Repairs |

### F. Lists of effective pages

A current list of LOEP dates (LOEP-LIST) is located behind the Title page of volume 1 and gives the chapter date when last revised.

A List of Effective Pages (LOEP) is located at the start of each chapter, to enable the user to check each chapter is complete and if it contains the latest issue of all pages. On each LOEP list, the date given against each page should agree with the date on the relevant page.

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## 3. Revisions

### A. Normal

Normal revisions to this manual are issued to give changes to maintenance information.

Paper Revisions

That part of the text which has been revised by the addition of, or a change in, information is shown by a solid revision bar adjacent to the text. Each revised page will ONLY show revision bars for text changed by the revision. There will not be a revision bar if text was deleted from the page.

Revised art will be identified by a revision bar in the left hand margin adjacent to the change.

The printed manual will have a Record of Revisions page. When a revision is inserted, the revision number, the date the revision is inserted into the manual, and the initials of the person(s) who insert the revision should be recorded on this page.

CD-ROM Revisions

Normal revised text on the CD-ROM will not have any revision bars adjacent to the text. For each revision of this manual, a new CD-ROM will be issued.

The CD-ROM may contain revised art. The pointing hand symbol will identify ONLY minor revisions to the art. Major revisions to the art will not be identified.

### B. Temporary

Temporary revisions are issued to give maintenance information in the interim between normal revisions. Each temporary revision is issued by the chapter number to which it applies followed by a sequential number in the order of publication (Temporary Revisions 12-1, 12-2 etc.). If relevant, the information in the temporary revision should be included in the next normal revision of the manual.

Temporary revisions are printed on yellow paper and are to be inserted in the maintenance manual in accordance with the instructions given on each page.

The printed manual will have a Record of Temporary Revisions page. The Record of Temporary Revisions is after the Record of Revisions page. When a temporary revision is inserted or removed from this manual, the appropriate information should be recorded on this page. A revised CD-ROM will be issued which will include the Temporary Revision.

### C. Record of revisions

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### D. Record of temporary revisions

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# CHAPTER

# 05

# TIME LIMITS/ MAINTENANCE CHECKS

# Chapter 5

## TIME LIMITS/MAINTENANCE CHECKS

### TABLE OF CONTENTS

TIME LIMITS .. .. .. Contained in separate manual titled Maintenance Schedule

SCHEDULED MAINTENANCE CHECKS .. Contained in separate manual titled Maintenance Schedule

UNSCHEDULED MAINTENANCE CHECKS .. Contained in separate manual titled Maintenance Schedule

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**LIST OF EFFECTIVE PAGES:** Chapter 5 - TIME LIMITS/MAINTENANCE CHECKS

| Reference / Page & Date | Reference / Page & Date | Reference / Page & Date |
|---|---|---|
| Contents 5 | | |
| 1 Oct.71 (W) | | |

* Indicates pages revised, added or deleted by the current revision.

# CHAPTER

# 06

# DIMENSIONS AND AREAS

## LIST OF EFFECTIVE PAGES: Chapter 6 - DIMENSIONS AND AREAS

| Reference / Page & Date | Reference / Page & Date | Reference / Page & Date |
|---|---|---|
| 6-00 | | |
| 1 Sept.78 (Y) | | |
| 2 Sept.68 (400) | | |

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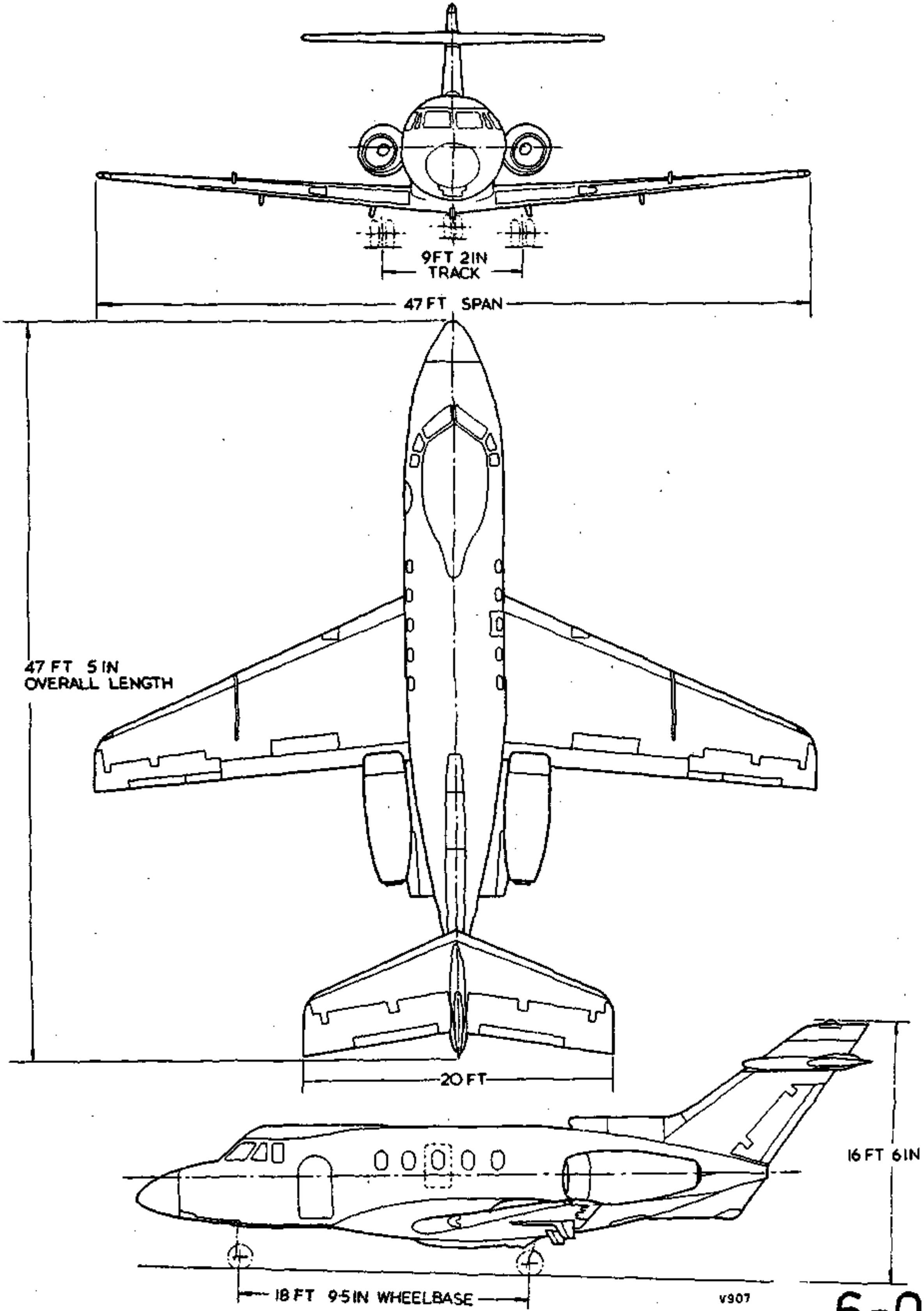
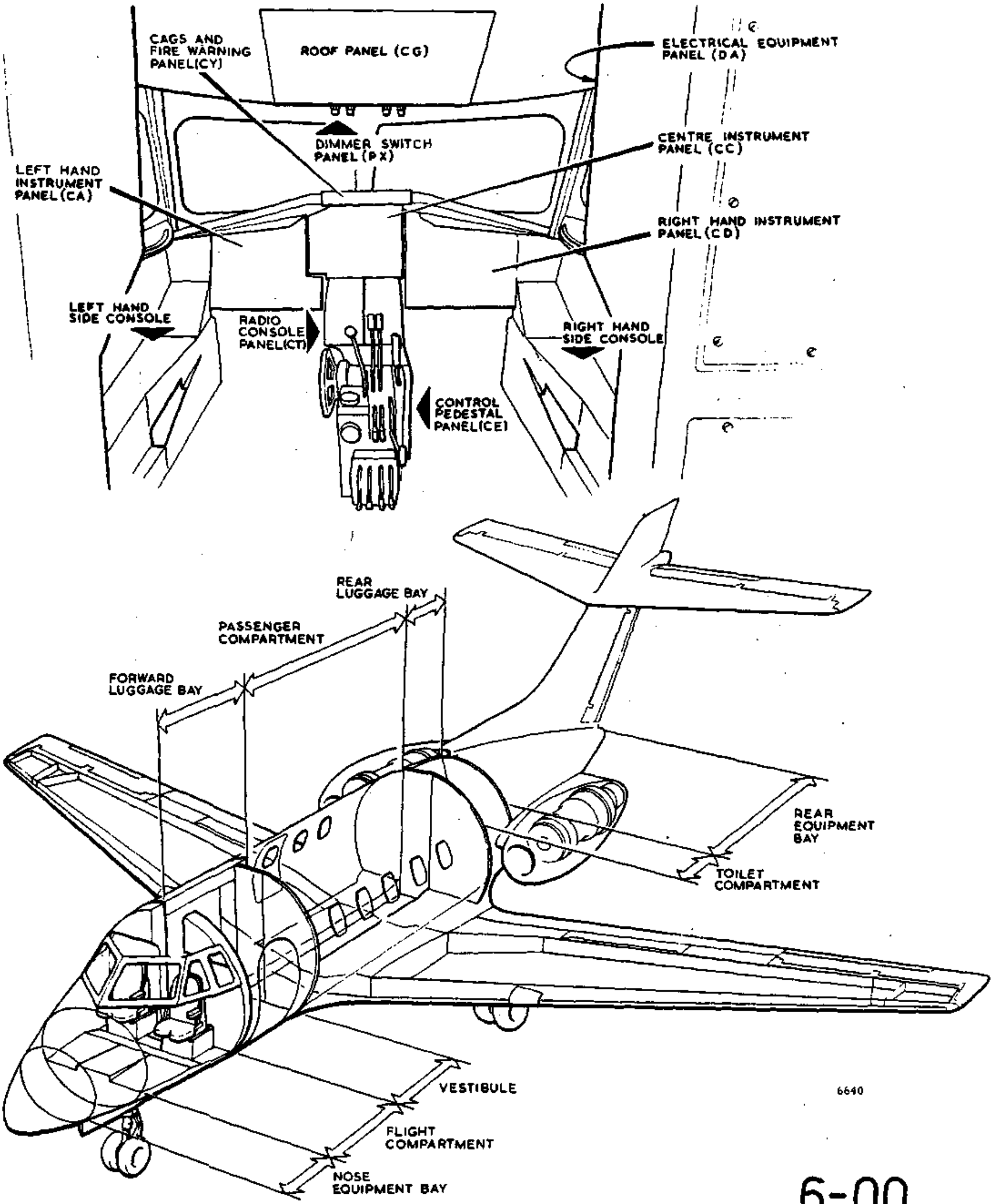


General arrangement
Fig.1



Area and panel nomenclature
Fig.2

* * *

# CHAPTER

# 07

# LIFTING AND SHORING

# CHAPTER 7

# LIFTING AND SHORING

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| | 2 | Apr.77 |
| 7-20-21 | 1 | Sept.78 |
| | 2 | Sept.75 |

# JACKING AND TRESTLING

## 1. General

**WARNING: WHEN AN AIRPLANE HAS EXPERIENCED ABNORMAL OR EMERGENCY LANDING GEAR PROCEDURES OF ANY TYPE, INCLUDING AN UNSAFE LANDING GEAR INDICATION OR EMERGENCY EXTENSION OF THE LANDING GEAR, PLACE THE AIRPLANE ON JACKS BEFORE PERFORMING ANY INSPECTION OR MAINTENANCE.**

**WARNING: MAKE SURE THAT ALL THREE LANDING GEARS ARE DOWN AND LOCKED BEFORE REMOVING THE AIRPLANE FROM JACKS .**

The airplane can be raised on jacks at three points, their locations being one at each wing root leading edge, and one at the rear of the fuselage.
Raising of the landing gear wheels for servicing purposes can be achieved by using a bottle jack at the appropriate leg. The jacking pads for this jack are integral parts of the gear leg assemblies.

## 2. Jack complete airplane

| Equipment/Material | Part/Item No. |
|---|---|
| Two wing point jacks: | Servisales JSR/DH/125/5MW or<br>Skyhi S545 on Mk. 1 Quad. legs with No. 54827 adapter or<br>Mingay ME5/2321C or ME7/2321C or Tronair.<br>Jacking pads 25Y67A. |
| One rear jack point: | SSL4-39-77 or Mingay ME5/3921 or ME7/3921or Tronair.<br>Any suitable tripod jack<br>Jacking pad 25Y13A |

*NOTE: Any suitable alternative jacking equipment may be used.*

Wing trestle profile boards (supplied undrilled for use with any suitable trestle) 25Y331A-332A.

### A. Limitations

Weight of airplane - 20,000lb maximum.
Do not jack the airplane in wind strengths greater than 20 knots. If the airplane is to be jacked in the open, it must be head into wind. Jack only on a good hard standing.

Before jacking, the fuel load in each wing must be equalized.

**B. Raise airplane for normal servicing procedures** *(Figure 1)*

(1) Remove bolts and hinge open wing jacking point access panels; remove tail bumper cap.

(2) Position a (wing point) jack at each wing jacking point. Install jacking pads to wing jacking sockets (and adapter heads to jacks if required).

(3) Align each jack with its corresponding jacking pad and lift jack transporter wheels clear of the ground.

(4) Make sure that jacks stand firmly on their bases and extend jacks until the adapter heads engage with jacking pads. Check that jacks are vertical.

(5) Check that the jacking area and area above the airplane, particularly the horizontal stabilizer, are free from obstruction, and the landing gear locking pins are installed.

(6) Select airplane brakes off, and remove chocks.

(7) Extend wing jacks in unison until airplane is level. As jack rams extend screw down lock collars.

(8) Position rear point jack at rear jacking point. If a four-legged jack is being used position the jack as shown. If a tripod jack is being used, position forward leg on, and two rear legs equally disposed about, the airplane center line. Install jacking pad to jacking point and adapter to head.

**CAUTION: DO NOT PLACE REAR JACK IN POSITION UNTIL AIRPLANE IS LEVEL.**

(9) Align rear jack with jacking pad and lift transporter wheels clear of ground. Make sure that jack stands firmly on its legs and extend jack until the adapter head engages with the jacking pad.

(10) Extend all three jacks simultaneously so that the airplane remains level. As the jack rams extend, screw down lock collars.

(11) Continue to raise the airplane until the main wheels are approximately three inches clear of the ground and the airplane is level.

(12) Lock jack rams by screwing down lock collars.

(13) If the airplane is to be subjected to fuel system servicing, necessitating full or part draining of the system from one wing, install trestles under each wing at rib 5.

**C. Raise airplane for removal and inspection of wing/fuselage attachment fittings in accordance with Repair Instruction Leaflet No.25/WS/32.**

Refer to 53-40-01 - WING/FUSELAGE FITTINGS - MAINTENANCE PRACTICES.

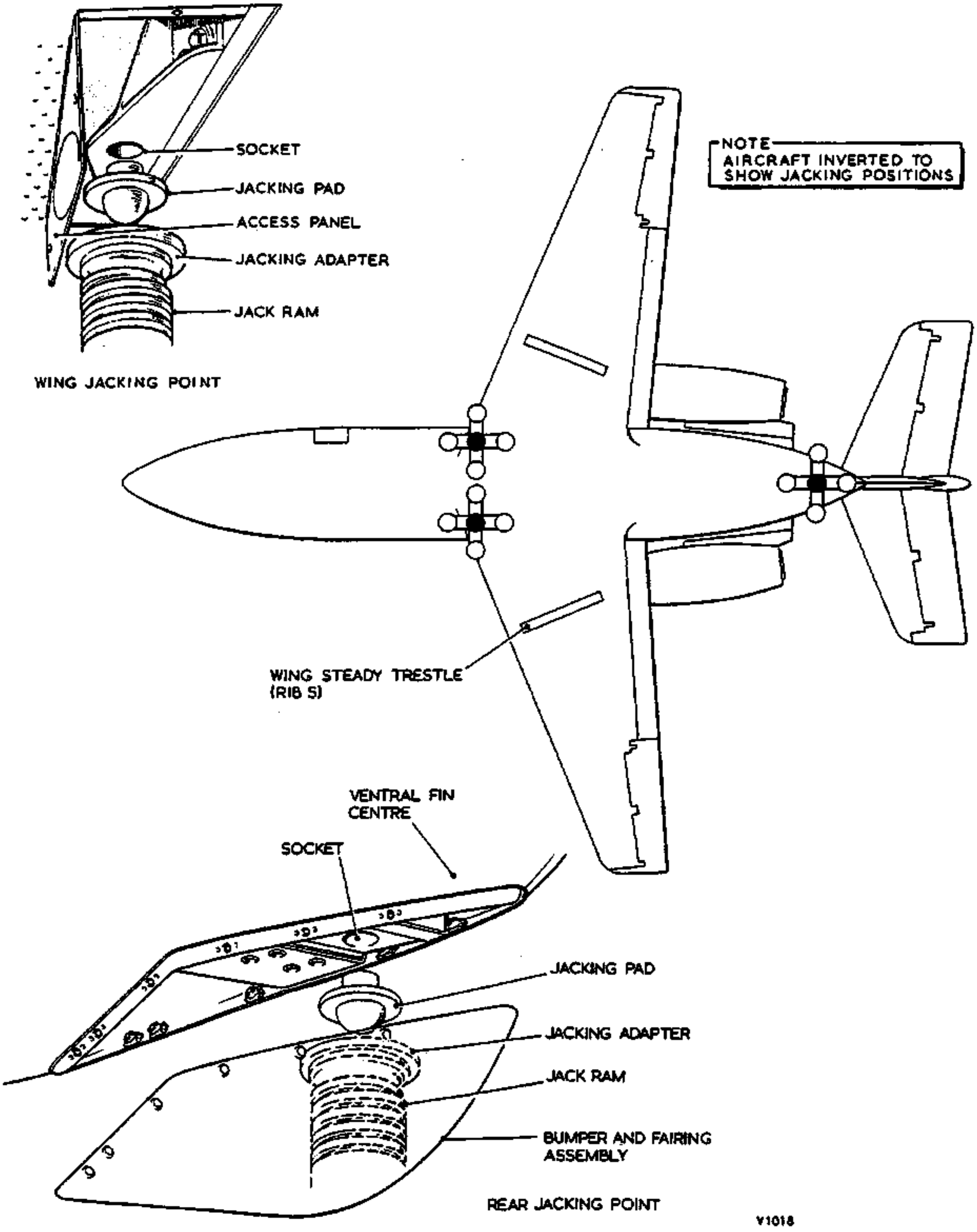
**D. Lower airplane**

**CAUTION: MAKE SURE BRAKES ARE OFF BEFORE LOWERING.**

(1) Make sure that fuel loads in each wing are equalized.

(2) Remove trestles and any equipment likely to foul the airplane during lowering.

(3) Make sure that landing gear is locked down and locking pins installed.



Jacking complete airplane

*Figure 1*

(4) Remove wing trestles.

(5) Extend each jack slightly to relieve the load on the ram lock collar. Partially unscrew the collar.

(6) Operate each jack pressure release valve simultaneously to make sure that the jacks retract together. Follow the jack rams with the lock collars.

**CAUTION: MOVE TAIL JACK CLEAR OF AIRPLANE AS SOON AS JACK IS UNLOADED. ANY DIFFERENCE BETWEEN LOWERING RATES AT THE MAIN JACK CAUSES TAIL MOVEMENT, WITH THE POSSIBILITY THAT THE TAIL JACK MAY FOUL THE AIRPLANE STRUCTURE.**

(7) When the weight of the airplane is taken on the landing gear, place chocks front and rear of wheels and, if possible, apply airplane brakes.

(8) Retract jack rams, lower transporter wheels, and move jacks clear of the airplane.

(9) Remove jacking pads from airplane sockets.

(10) Install wing jacking point access panels, install tail bumper cap.

## 3. Jack main or nose gear wheels

| Equipment required. | Part/Item No. |
|---|---|
| Wheel change jack | Mingay ME6/55 or Servisales JSR/DH/125/5 |

*NOTE: Any suitable alternative jacking equipment may be used.*

### A. Limitations

Weight of airplane - up to maximum take-off weight. The jack can be placed in position if one or both tires are deflated provided the distorted tires permit its correct positioning, if not it will be necessary to raise the wheels by insertion of wooden blocks under the tires or by normal jacking.

### B. Raise and lower main or nose gear wheels *(Figure 2)*

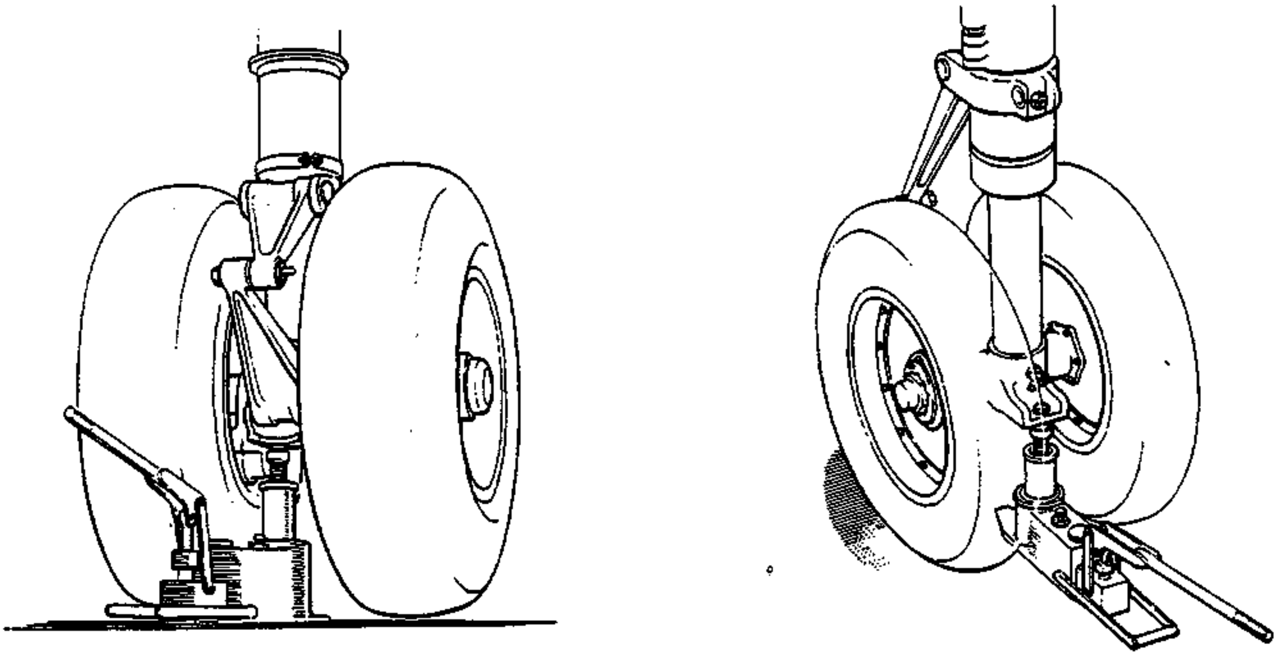
(1) Position chocks to the front and rear of wheels not being serviced.

(2) Position jack and extend jack ram to engage jacking head with leg jacking pad.

(3) Extend jack until the wheels are clear of the ground.

(4) When wheel servicing is completed, operate release valve to retract the jack.

(5) Remove jack, place chocks front and rear of wheels and, if possible, apply brakes.


MAIN GEAR— WHEEL JACKING

NOSE GEAR— WHEEL JACKING

Jacking nose and main gear
*Figure 2*

# SALVAGING

## 1. General

Methods of salvaging a crashed aircraft will depend upon the prevailing circumstances governed by such conditions as accessibility, nature of ground at accident area and extent of damage to aircraft.

Before attempting to lift a crashed aircraft reduce the overall weight as much as possible by removing all loose equipment and other equipment which is easily detachable.

The aircraft should be defuelled if the defuelling points are accessible; if they are not accessible, it may be possible to reduce the fuel load by breaking the engine fuel feed lines at a convenient joint and applying suction - the aircraft fuel pumps should not be used.

If possible, render the aircraft safe by :-

(1) Turning off the oxygen supply and removing the bottle(s).

(2) Disconnecting and removing batteries.

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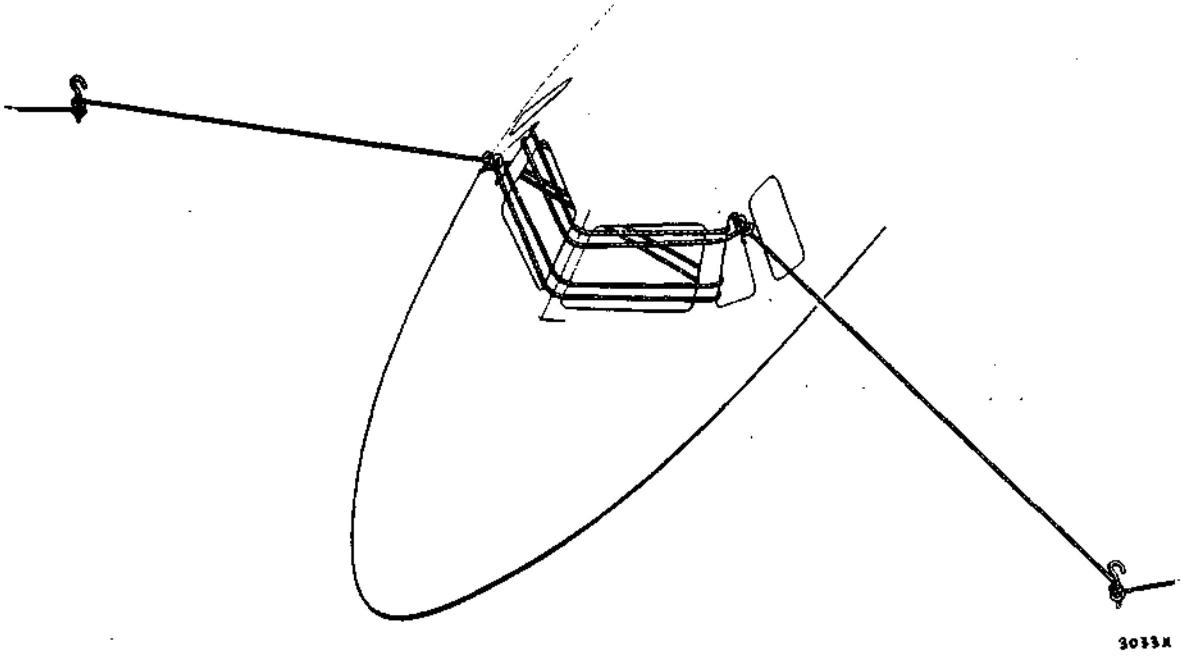

Nose handling lines
Fig. 1

...Salvaging continued

The aircraft may be lifted by the use of cranes, lifting bags or jacks, or by a combination of these methods. The method employed will be determined by the condition and position of the aircraft. When lifting the aircraft by cranes or lifting bags, handling lines should be attached to the aircraft at convenient strong points. Those handling lines are necessary to control swing if the lifting is by crane, or roll if lifting bags are used; the free ends of the lines should have two or three turns taken around a convenient anchorage point. A strong point is provided at the tail by the jacking and picketing fitting, and at the nose of the aircraft by the windscreen structure after opening the windscreen panels B (Fig. 1). Anchorage points can be heavy vehicles or, on soft ground conditions, ground pickets.

* * *

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# USE OF LIFTING BAGS

## 1. General

Lifting bags can be used to raise a crashed aircraft from the ground providing there is sufficient clearance to insert the deflated bag between the approved lifting areas and the ground.

Lifting bags should not be used in cases where aircraft damage could puncture the bag. Use protective tarpaulins on the ground after removal of all sharp objects.

Carry out the lifting operation in minimum wind conditions.

The areas under the wings where lifting bags may be applied are shown on Fig. 1. "Safe areas" marked carry no limitations. "Permissible if necessary" areas may be used provided care is exercised during lifting, as excessive loading may cause crushing in the area between ribs 8 and 11 and damage to the leading edge if the bag tends to fold around it. "Not recommended" areas should be avoided as damage may result to both the wing and lifting bag.

When positioning bags, remember that easy access may be required, during or after the lifting operation, to the main jacking points and the defuelling valves.

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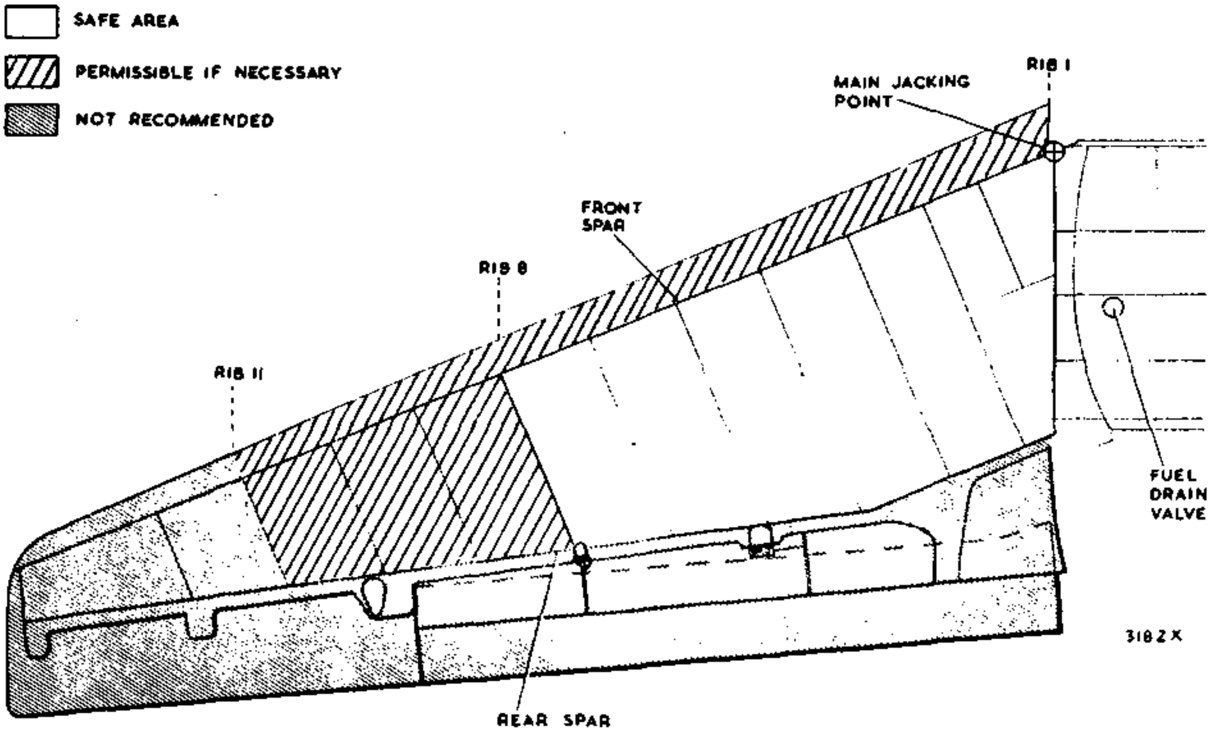


Positioning lifting bags
Fig. 1

...Use of lifting bags continued

2. Procedure

Equipment required :-

A minimum of two lifting bags (9 ft. by 6 ft.).
A portable air compressor capable of delivering up to 6 lb/sq.in.
Handling lines.

(1) Prepare the aircraft for lifting by off-loading equipment, and fuel if possible, and rendering the aircraft safe (see Chapter 7, SALVAGING).

(2) Attach handling lines to convenient strong points on the aircraft and to ground anchorage points (see Chapter 7, SALVAGING).

(3) Examine the area in which the lifting bags will be used and ensure that no sharp objects are present. Lay down protective tarpaulins.

(4) Check that the bags are serviceable and prepared for lifting in accordance with the current instructions for the particular type of bag being used. Place bags in position beneath left and right wings (Fig.1).

(5) Slowly inflate the bags. As the aircraft rises, pay out the handling lines. Control the lateral level of the aircraft by the inflation rate of the bags. Do not allow inflation pressures to exceed the maximum recommended for the type of bag being used.

(6) When aircraft has reached required height, steady in position by tensioning and securing handling lines.

(7) Proceed to recover aircraft by appropriate method, that is, place on aircraft landing gear, on jacks or on salvage trolley.

(8) When weight of aircraft has been taken, slowly release bag pressures. Remove bags and handling lines.

* * *

# SLINGING AIRCRAFT

## Equipment required

| | |
|---|---|
| Sling, complete aircraft .. .. .. | BAe Pt.No.25Y 29A/C (s.w.l. 12,420 lb) |
| Suitable crane | |

## 1. General

The sling consists of a frame with a lifting band, embodying a profile board at the forward end and two cable assemblies at the rear. The forward lifting band is taken around the fuselage at frame 8 and each rear cable assembly is attached to a lifting eye screwed into the top surface of the wing rear spar, adjacent to the rib 4 intersection.

The tubular frame can be dismantled for ease of transportation. When assembled, the four components are held in position by locking clamps.

## 2. Procedure (Fig.1)

(1) Prepare the aircraft for lifting by off-loading loose equipment and fuel, to reduce the aircraft weight to the safe working load of the sling, and rendering the aircraft safe (see Chapter 7 - SALVAGING).

(2) Attach handling lines to convenient strong points and to ground anchorage points (see Chapter 7 - SALVAGING).

(3) If necessary, lift aircraft with lifting bags to provide sufficient clearance to fit sling forward lifting band (see Chapter 7 - USE OF LIFTING BAGS). Alternatively, if the ground is suitable, the clearance may be obtained by digging.

(4) If sling has been dismantled for transportation, assemble and lock with locking clamps.

(5) Lift sling with crane and position crane so that forward spreader bar is above frame 8. Slowly lower sling until forward spreader bar rests on fuselage and then continue to lower sling until wing lifting eyes can be inserted. If covers are fitted over wing lifting points, slacken screws and swing covers clear of holes in wing skin. Screw in wing lifting eyes until the fork ends bottom into sockets to ensure full thread engagement, back off one complete turn and align fork ends fore and aft as shown on Fig.1.

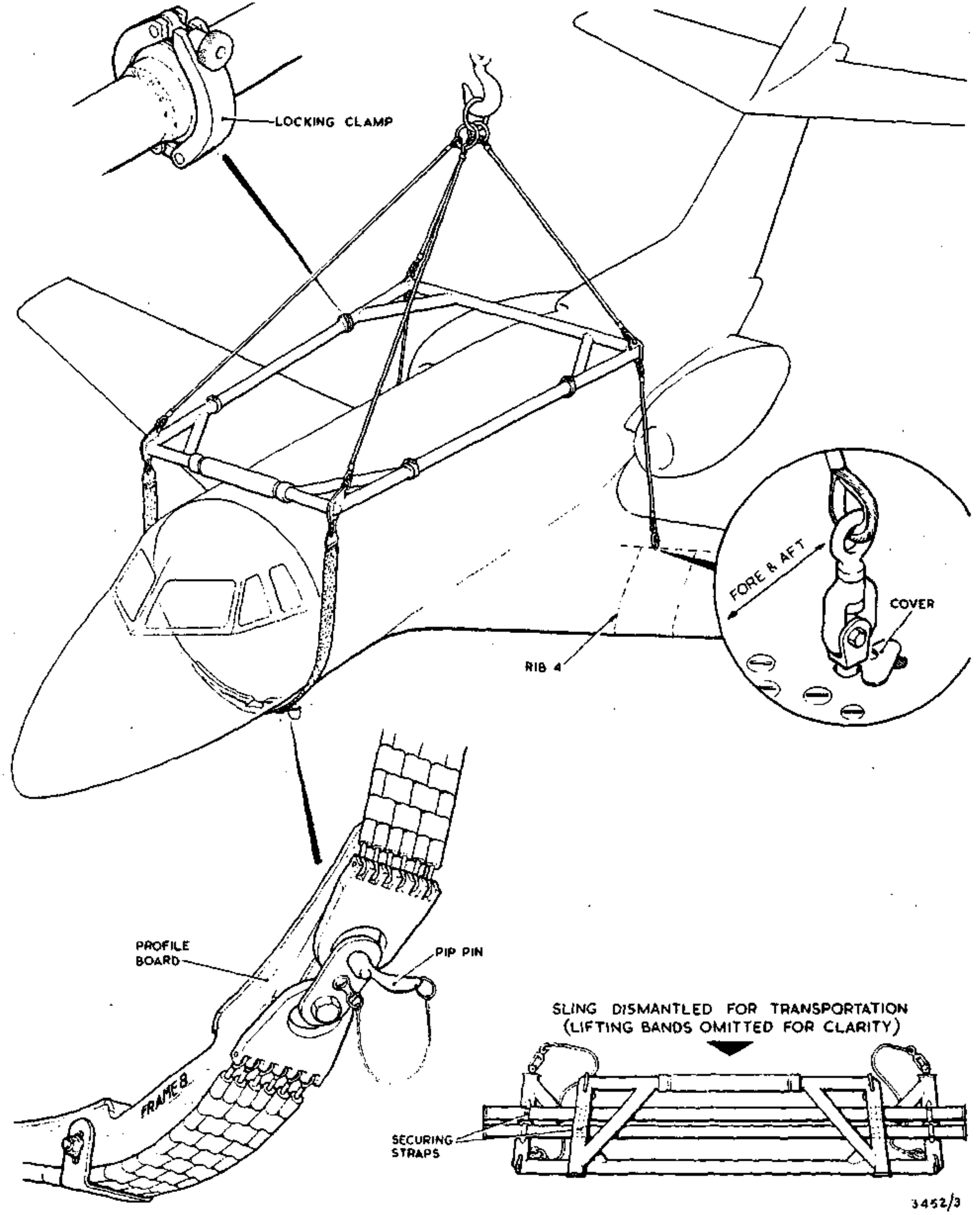
(6) Position profile board of forward lifting band around fuselage at frame 8 and connect free band to board with Pip pin.

(7) Re-position crane to obtain vertical lift and lift aircraft.

NOTE : Ensure that the attitude of the sling cables is maintained during lifting operations within the following limits :-

Fore and aft :- VERTICAL ± $5^{\circ}$ Spanwise :- NORMAL TO SPAR ± $5^{\circ}$

Fig.1 overleaf



Lifting complete aircraft
Fig.1

* * *

# CHAPTER

# 08

# LEVELING AND WEIGHING

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* Indicates pages revised, added or deleted by the current revision.

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# LEVELLING AND WEIGHING

## 1. General

This chapter describes the method of levelling the aircraft; for weighing procedures and loading data, refer to the Weight and Balance Manual

### A. Equipment required

| | |
|---|---|
| To jack aircraft ... ... | See Chapter 7 |
| Fuselage fore and aft levelling bar ... | 25Y23A |
| Fuselage transverse levelling bar ... | 25Y21A |
| Clinometer ... ... ... | 90° |

### B. Level aircraft

**NOTE :** When levelling the aircraft for major rigging checks, the fuel tanks must be empty.

With the aircraft jacked as described in Chapter 7 and in an area free from wind and preferably under cover, proceed as follows (see Fig. 1)

(1) Mount fuselage transverse levelling bar on the datum bolts on left and right hand seat rails.

(2) Place the clinometer on the upper surface of the bar.

(3) Adjust the aircraft wing jacks until the clinometer reads zero.

(4) Mount fuselage fore-and-aft levelling bar on the datum bolts on the passenger cabin right-hand seat rail.

(5) Place the clinometer on the upper surface of the bar.

(6) Adjust the aircraft rear jack until the clinometer reads zero.

(7) Recheck fuselage transverse level.

Fig. 1 overleaf

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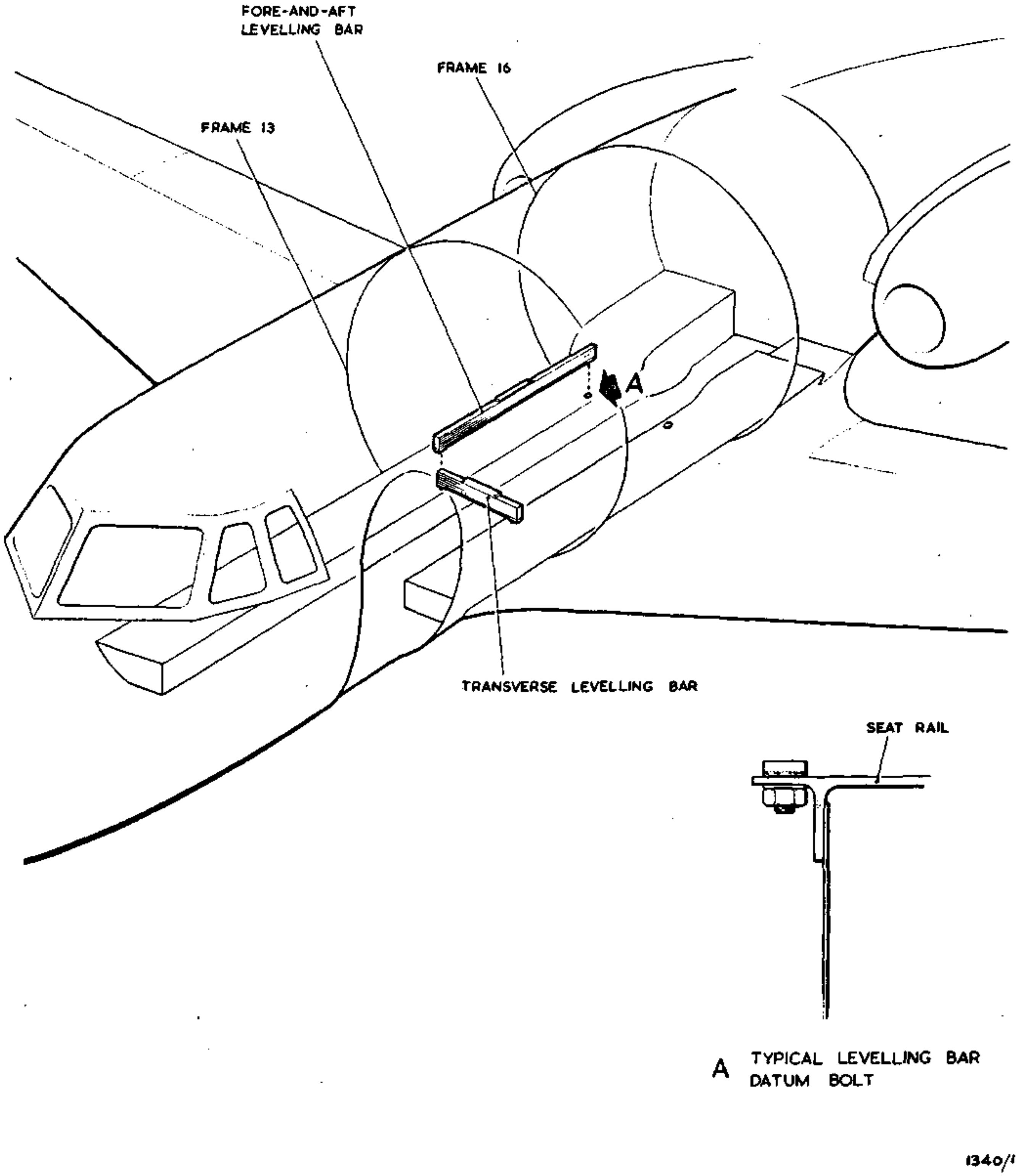
FORE-AND-AFT LEVELLING BAR
FRAME 16
FRAME 13
A
TRANSVERSE LEVELLING BAR
SEAT RAIL
A TYPICAL LEVELLING BAR DATUM BOLT
1340/1

Aircraft levelling
Fig.1

* * *

# CHAPTER

# 09

# TOWING AND TAXIING

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# TOWING AND TAXIING - MAINTENANCE PRACTICES

## 1. General

**WARNING: WHEN TOWING AN AIRCRAFT WITH ZERO FUEL AND EQUIPMENT REMOVED FROM THE FRONT, STOW BALLAST FORWARD TO COMPENSATE FOR THE AFT C.G. CONDITION.**

The aircraft can be towed or pushed using a towbar. For radius of turns, see *Figure 201*. Before the aircraft is towed or pushed, disconnect the nose wheel steering sleeve from torque link sleeve on the leg assembly by removing the steering disconnect pin. For manoeuvring by hand a steering arm Pt.No.25Y513A is available.

The recommended towing speed for the aircraft under normal conditions is 5 mph and the gradient should not be steeper than 1 in 6.

Position a competent operator in the flight compartment to operate the aircraft brakes.

Establish efficient liaison between tractor driver and brakes operator before the aircraft undergoes any towing operations.

Taxiing instructions are given in the Crew Manual.

## 2. Tow aircraft

### A. Towbar

25Y79A/D: with shear pins Pt.No.25Y395 (for side loads) and Pt.No.25Y1517 (for push/pull loads).

### B. Procedure *(Figure 202)*

(1) Make sure that the nose and main gear locking pins are installed.

(2) Withdraw quick-release pin and remove steering disconnect pin. Stow quick-release pin in hole in head of disconnect pin.

(3) Locate and attach towbar to torque link sleeve by inserting the steering disconnect pin in the tow position of the sleeve. Turn towbar safety catch to lock tow pin.

(4) Connect towbar to the tractor.

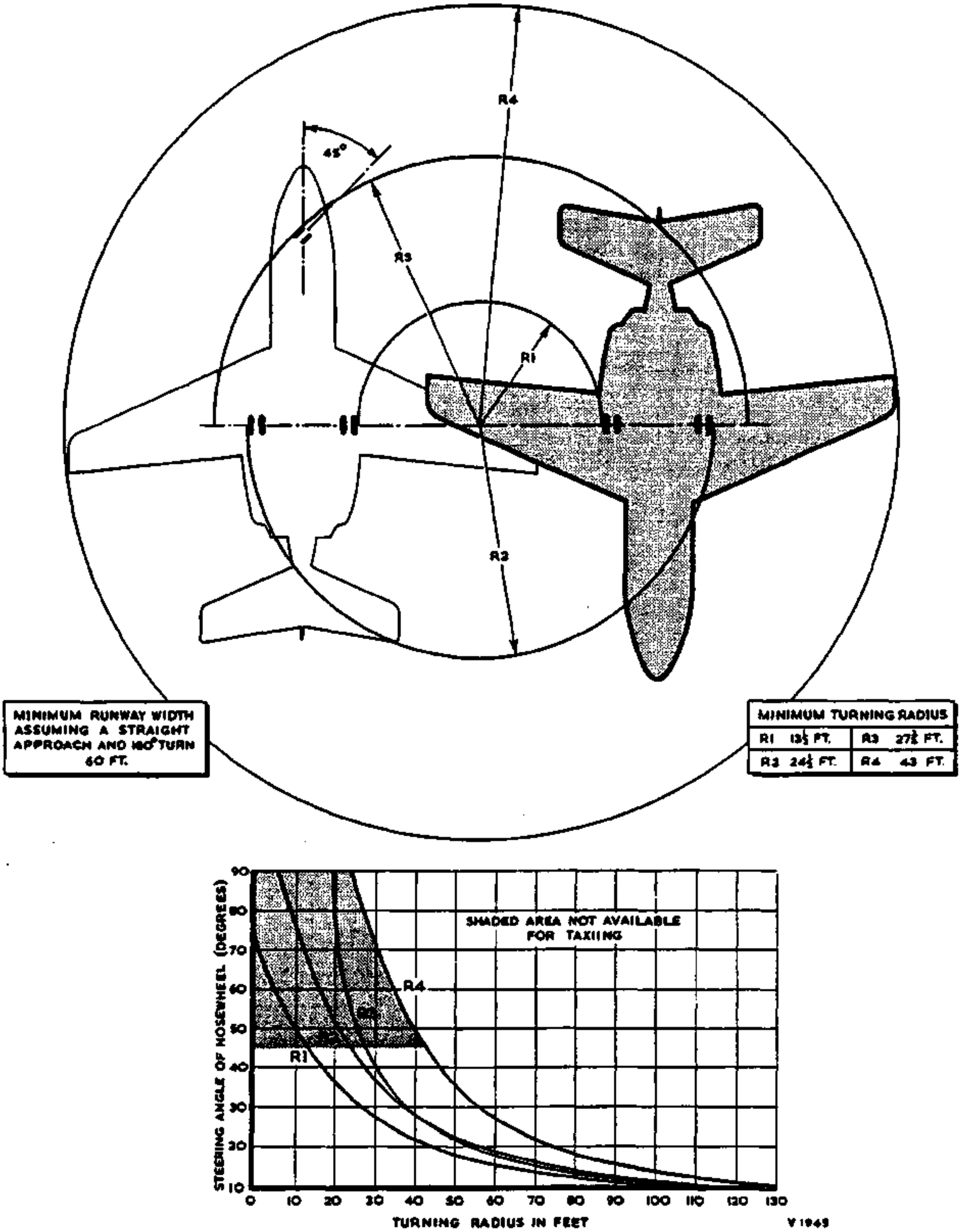
(5) Station a competent brake operator in the flight compartment.

(6) Position an observer at each wing tip, and at the rear of the aircraft, if it is being pushed.

(7) Establish suitable liaison between brake operator and tractor driver.

(8) Check that a pressure of 2000 psi minimum is indicated on the emergency brake accumulator gauge in the rear equipment bay. If necessary, top up the system by operating the hydraulic handpump situated adjacent to the accumulator.

(9) Operate handbrake lever to the emergency position.



MINIMUM RUNWAY WIDTH
ASSUMING A STRAIGHT
APPROACH AND 180° TURN
60 FT.

| MINIMUM TURNING RADIUS | |
|---|---|
| R1 13½ FT. | R3 27⅜ FT. |
| R2 24½ FT. | R4 43 FT. |

Turning radii
*Figure 201*

(10) If required, switch on navigation lights.

(11) Close entry door.

(12) Tow the aircraft steadily at a speed not exceeding 5 m.p.h. (8 km.p.h.).

(13) On arrival at the parking position, centralize nose gear, check brake pressure and top up as necessary. Operate handbrake lever to PARK, and position chocks front and rear of main and nose gear wheels.

(14) Disconnect towbar. Insert disconnect pin through torque link sleeve and steering sleeve; lock the disconnect pin by inserting the quick-release pin through the counterbored 0.25 inch diameter hole in the forward face of the torque link sleeve. Make sure that the quick-release pin is locked in position with the indicator groove exposed and level with the head.

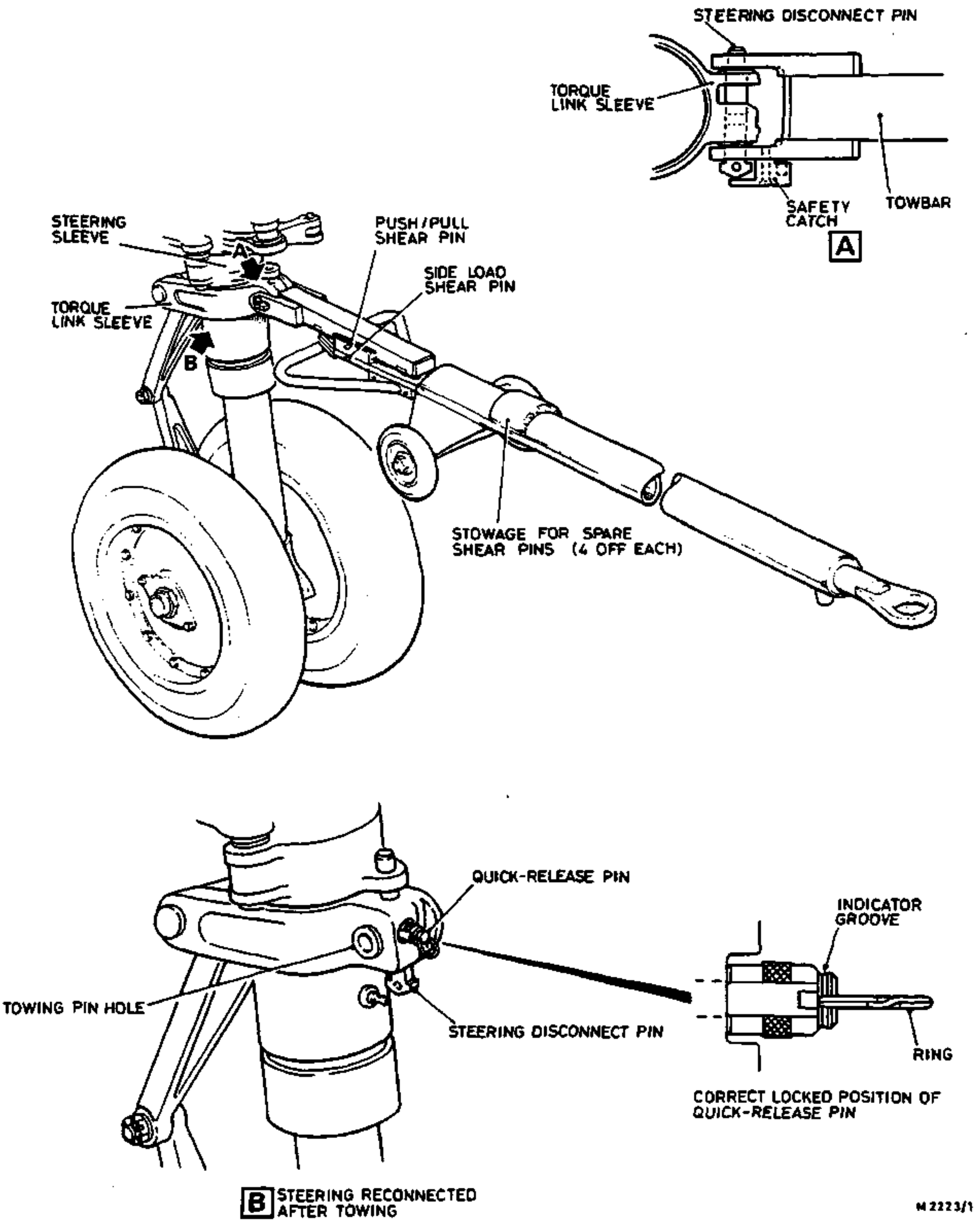
If a pattern type towbar is used for towing which does not provide a catch to retain the steering disconnect pin, the disconnect pin should be retained by the use of the quick release pin.

## 3. Towing requirements.

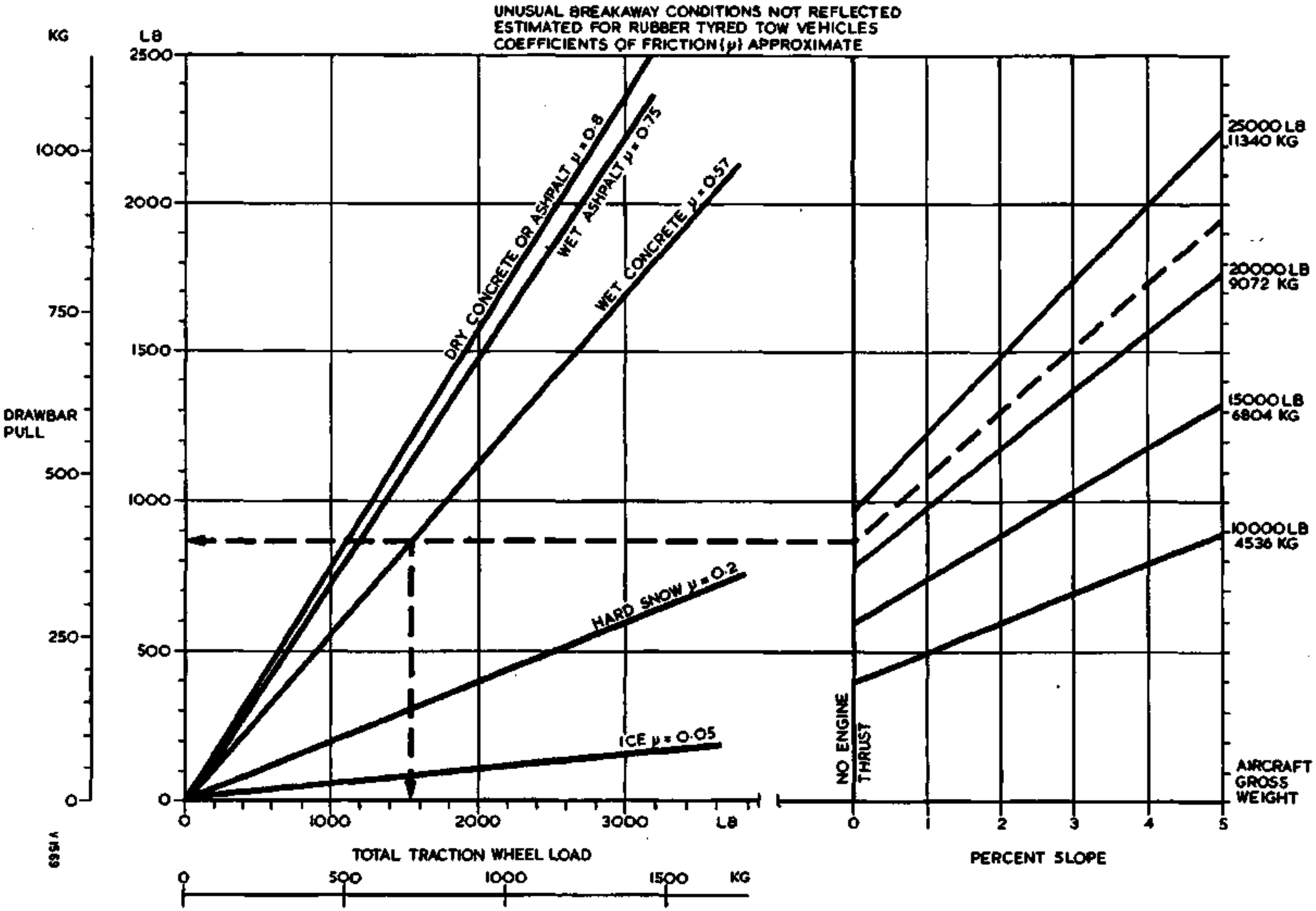
### A. Approximate towing loads

The tractor drawbar pull required under various conditions, and the traction wheel loading necessary to prevent slippage are shown graphically on *Figure 203*.

As an example, the dotted line shows that an aircraft weighing 22,000 lbs. (9979 kgs.) being towed at zero slope requires 880 lbs. (399 kgs.) drawbar pull and a minimum of 1,500 lbs. (680 kgs.) load on traction wheels on wet concrete.



Towing aircraft
*Figure 202*



Towing requirements
*Figure 203*

# CHAPTER

# 10

# PARKING, MOORING, STORAGE, RTN TO SVC.

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| | | 6 | Sept.68 (400) | | |
| | | 7 | Apr.77 | | |

* Indicates pages revised, added or deleted by the current revision.

# PARKING AND MOORING

## 1. General

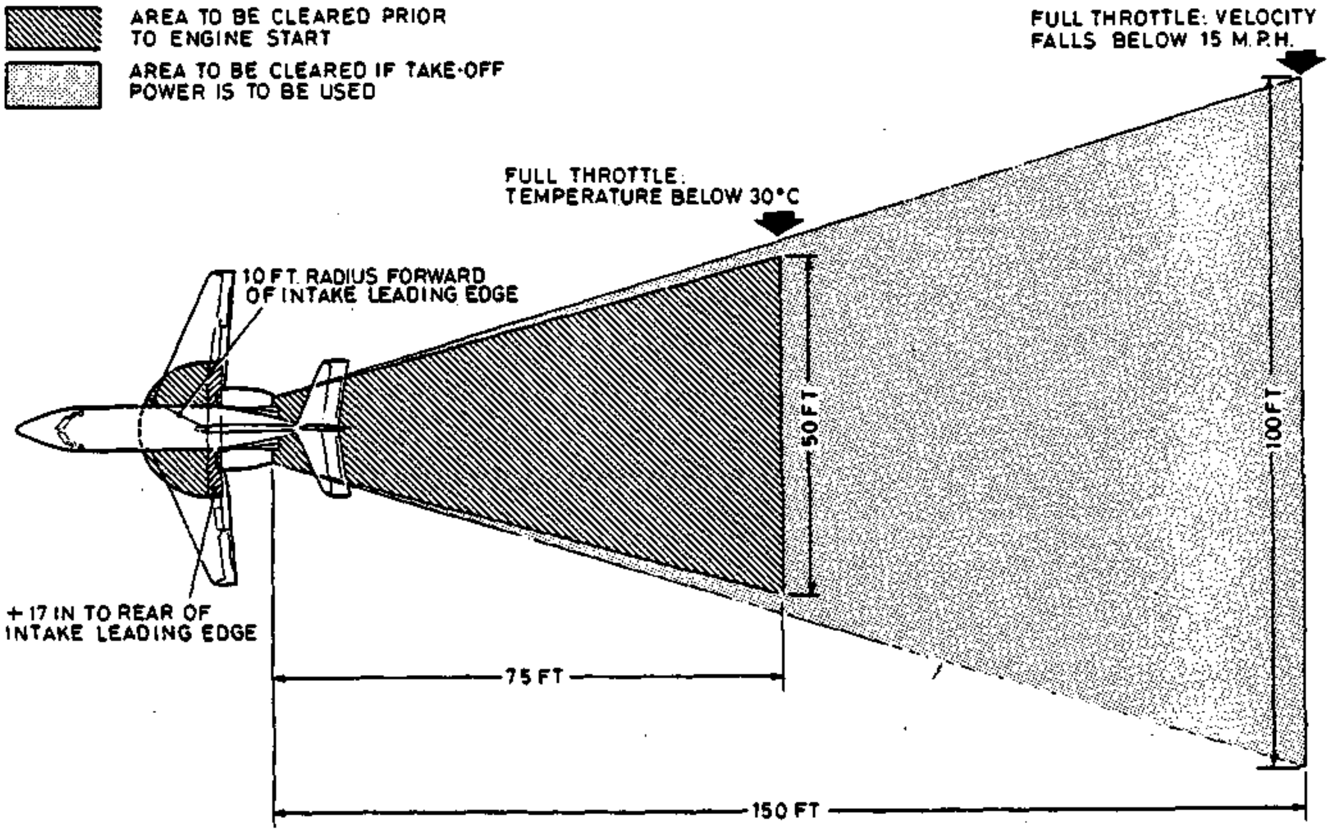
When parking or mooring the aircraft centralize the nose landing gear and if possible head into wind.

Fit landing gear lock pins as soon as possible after landing and do not remove them, except where necessary for aircraft maintenance, until immediately prior to engine starting for take-off.

As necessary, apply the wheel brakes.

Covers, blanks and guards should be fitted where necessary for protection of components and systems. Additional covers, blanks and guards may be used to assist in safeguarding personnel from hazards associated with projections or moving parts.

Internal flying control locks are provided. When Mod.251742 is embodied, the aileron and elevator lock also operates a throttle baulk, which prevents both throttles being opened fully at the same time (see Chapter 27).


▨ AREA TO BE CLEARED PRIOR TO ENGINE START
▒ AREA TO BE CLEARED IF TAKE-OFF POWER IS TO BE USED
FULL THROTTLE: VELOCITY FALLS BELOW 15 M.P.H.
FULL THROTTLE: TEMPERATURE BELOW 30°C
10 FT RADIUS FORWARD OF INTAKE LEADING EDGE
+ 17 IN TO REAR OF INTAKE LEADING EDGE
50 FT
100 FT
75 FT
150 FT
V 2302

Danger areas
Fig. 1

...Parking and mooring continued

Before starting up the engines, take care in choosing the position of the aircraft in relation to any adjacent buildings or aircraft.

WARNING : DANGER AREAS ARE ILLUSTRATED ON FIG.1 TOGETHER WITH PRECAUTIONS WHICH SHOULD BE OBSERVED WITHIN THESE AREAS.

2. Park aircraft

(1) Position aircraft nose into wind and centralize the nose gear wheels.

(2) Fit landing gear locking pins (Fig.2).

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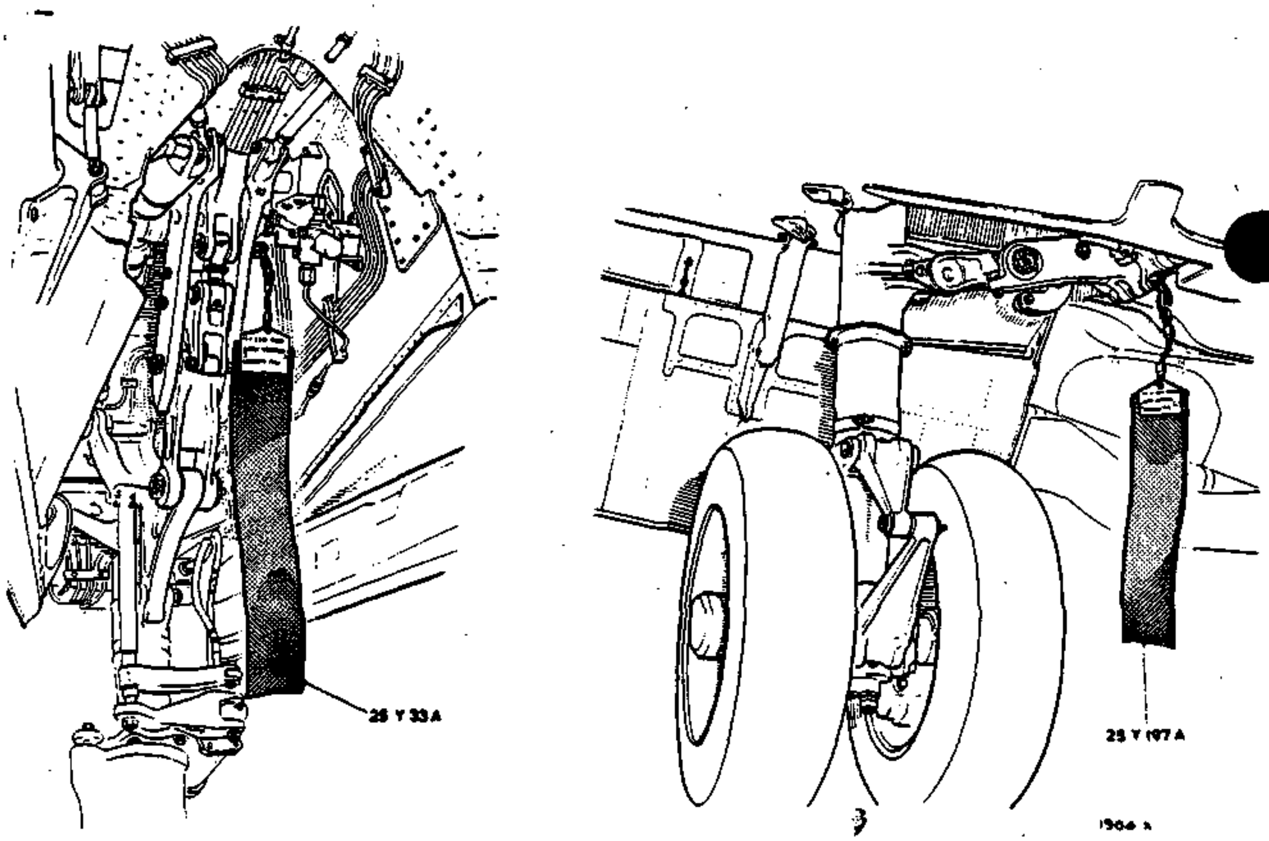


Landing gear locking pins
Fig.2

...Parking and mooring continued

(3) Fit internal flying control locks (Figs. 5 and 6).

(4) Check that a pressure of 2000 lb/sq.in. minimum is indicated on the emergency brake accumulator gauge in the rear equipment bay. If necessary, top up the system by operating the hydraulic handpump, situated adjacent to the accumulator.

(5) Apply handbrake fully to the PARK position.

(6) Position wheel chocks front and rear of nose and main gear wheels.

(7) Fit protective covers and guards, as necessary.

CAUTION : ALLOW PITOT HEADS TO COOL BEFORE FITTING PITOT COVERS.

(8) If ambient temperature is likely to drop below freezing point, drain water/waste system (see Chapter 12, WATER/WASTE).

## 3. Covers (Fig.3)

Protective covers or blanks are available for the following :-

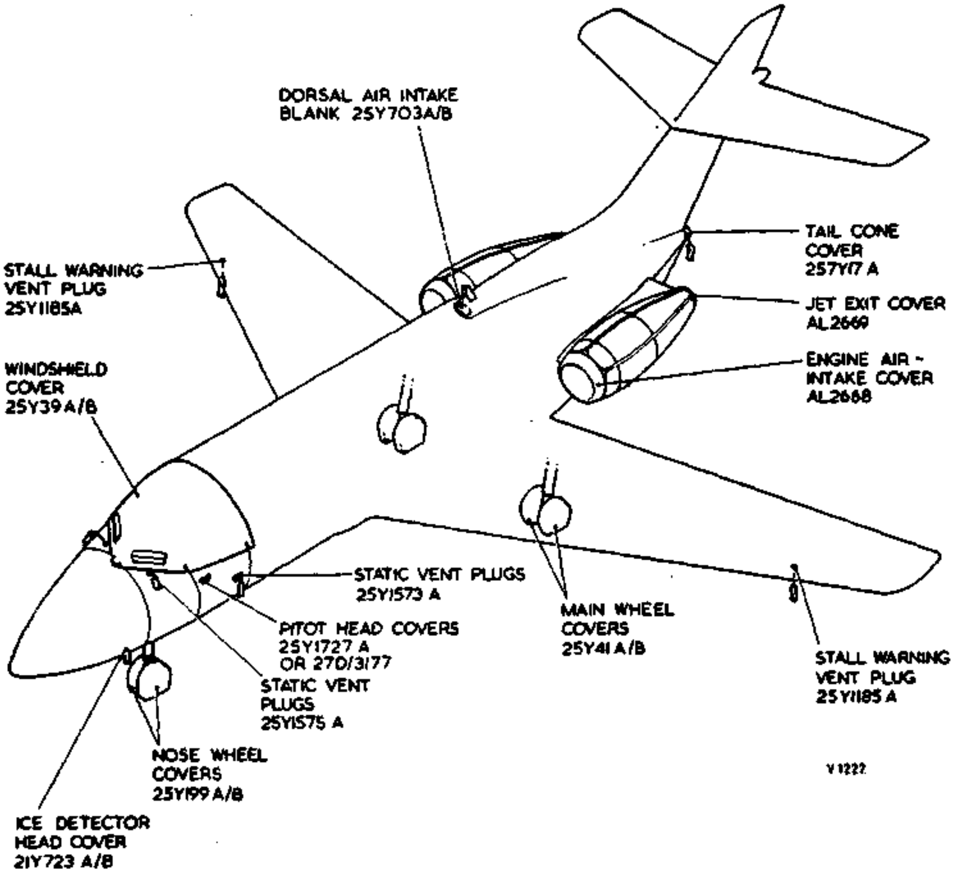
Engine intakes
Jet exits
Static vents
Nose and main gear wheels
Pitot heads
Windshield
Ice detector head
Dorsal air intake
Tail cone
Stall warning vents

It is recommended that the engine air intake, jet exit and tail cone covers are fitted at all times when the aircraft is parked, and removed only for servicing purposes or when the engines are to be run. Other covers must be fitted in adverse weather conditions or if the aircraft is to stand for an extended period.

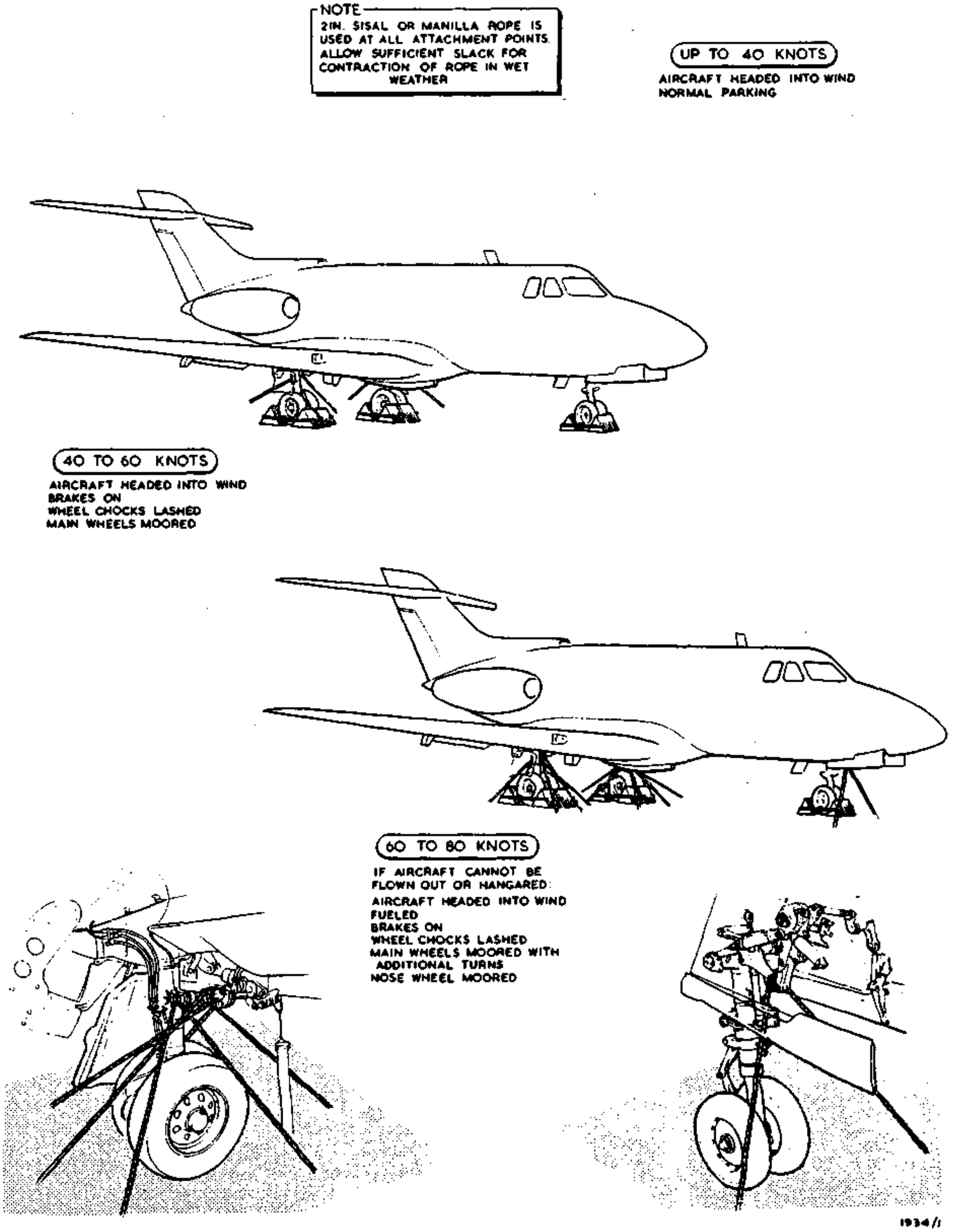
## 4. Moor aircraft

Provided that the aircraft is head into wind and parking brakes are used in conjunction with chocks front and rear of main and nose gear wheels, no mooring is necessary in winds less than 40 knots.

...Parking and mooring continued


DORSAL AIR INTAKE BLANK 25Y703A/B
STALL WARNING VENT PLUG 25Y1185A
TAIL CONE COVER 257Y17 A
JET EXIT COVER AL2669
ENGINE AIR - INTAKE COVER AL2668
WINDSHIELD COVER 25Y39A/B
STATIC VENT PLUGS 25Y1573 A
PITOT HEAD COVERS 25Y1727 A OR 270/3177
MAIN WHEEL COVERS 25Y41 A/B
STALL WARNING VENT PLUG 25Y1185 A
STATIC VENT PLUGS 25Y1575 A
NOSE WHEEL COVERS 25Y199 A/B
ICE DETECTOR HEAD COVER 21Y723 A/B
Y1222

Covers and guards
Fig.3



NOTE
2IN. SISAL OR MANILLA ROPE IS USED AT ALL ATTACHMENT POINTS. ALLOW SUFFICIENT SLACK FOR CONTRACTION OF ROPE IN WET WEATHER

UP TO 40 KNOTS
AIRCRAFT HEADED INTO WIND
NORMAL PARKING

40 TO 60 KNOTS
AIRCRAFT HEADED INTO WIND
BRAKES ON
WHEEL CHOCKS LASHED
MAIN WHEELS MOORED

60 TO 80 KNOTS
IF AIRCRAFT CANNOT BE FLOWN OUT OR HANGARED:
AIRCRAFT HEADED INTO WIND
FUELED
BRAKES ON
WHEEL CHOCKS LASHED
MAIN WHEELS MOORED WITH ADDITIONAL TURNS
NOSE WHEEL MOORED

Mooring
Fig.4

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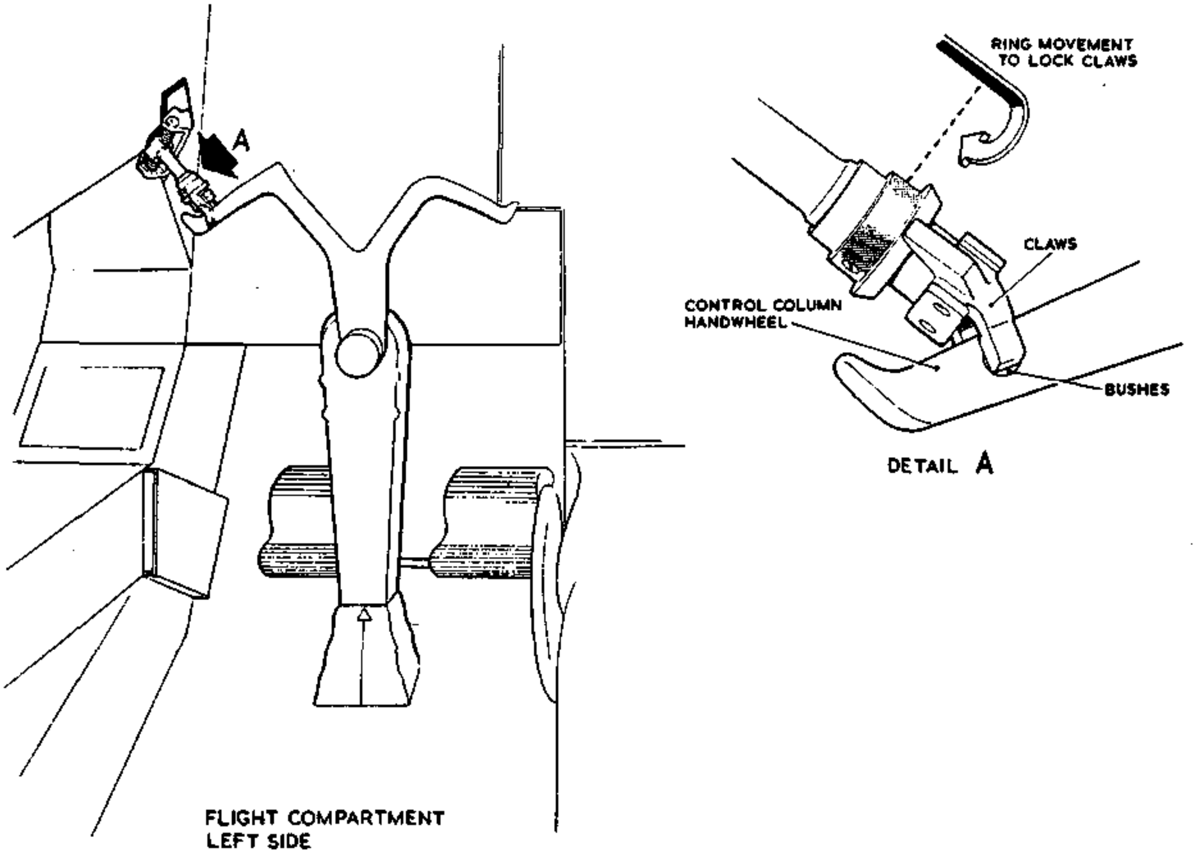


FLIGHT COMPARTMENT LEFT SIDE

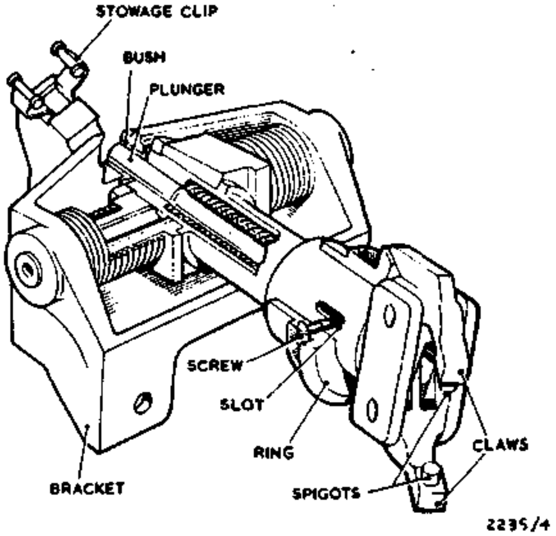
DETAIL A

**TO FIT GUST LOCK:-**

1. RELEASE GUST LOCK FROM STOWAGE CLIP, SWING LOCK ROUND AND WITH AILERON HANDWHEEL NEUTRAL, POSITION CLAWS ON HANDWHEEL.
2. CLOSE SPIGOTS ON CLAWS INTO HANDWHEEL BUSHES BY PUSHING KNURLED RING DOWN AND TURNING CLOCKWISE. ENSURE PLUNGER ENGAGES BUSH IN MOUNTING BRACKET.

**TO REMOVE GUST LOCK:-**

1. TURN KNURLED RING ANTI-CLOCKWISE TO RELEASE CLAW SPIGOTS FROM HANDWHEEL BUSHES.
2. SWING GUST LOCK BACK AND SECURE IN STOWAGE CLIP.

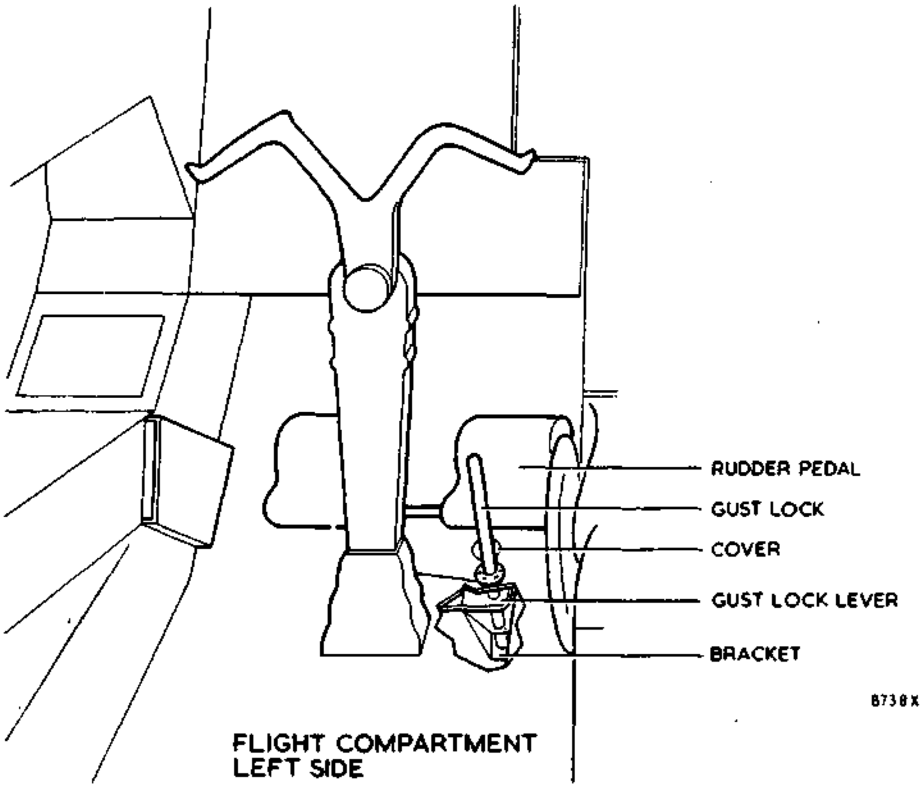


GUST LOCK

Gust lock - Ailerons and elevators
Fig.5

TO FIT GUST LOCK

1. REMOVE GUST LOCK FROM STOWAGE.
2. POSITION RUDDER PEDALS AT NEUTRAL.
3. LIFT COVER IN FLOOR AND INSERT GUST LOCK THROUGH GUST LOCK LEVER AND BRACKET.



TO REMOVE GUST LOCK

1. LIFT GUST LOCK FROM LEVER AND BRACKET.
2. CLOSE FLOOR COVER.
3. STOW GUST LOCK ON SHROUD FORWARD OF CO-PILOT"S SEAT MOUNTING.

Gust lock - rudder
Fig.6

* * *

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# CHAPTER

# 12

# SERVICING

# CHAPTER 12

# SERVICING

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| | 303 | Dec.99 |
| | 304 | Dec.99 |

# SERVICING - DESCRIPTION AND OPERATION

## 1. General

**WARNING:** **WHEN AN AIRPLANE HAS EXPERIENCED ABNORMAL OR EMERGENCY LANDING GEAR PROCEDURES OF ANY TYPE, INCLUDING AN UNSAFE LANDING GEAR INDICATION OR EMERGENCY EXTENSION OF THE LANDING GEAR, PLACE THE AIRPLANE ON JACKS (AMM 7-10-00) BEFORE PERFORMING ANY INSPECTION OR MAINTENANCE.**

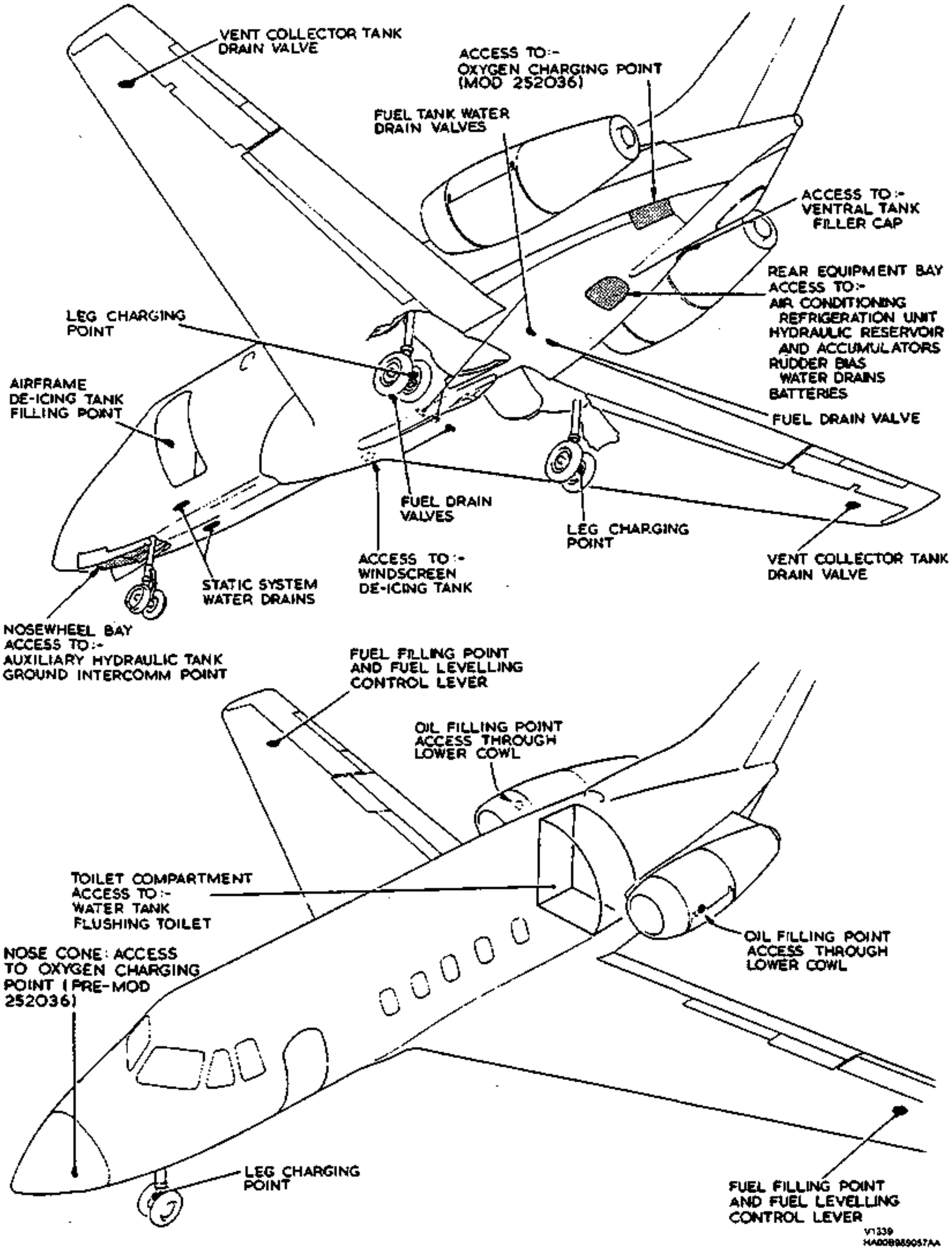
**WARNING:** **MAKE SURE THAT ALL THREE LANDING GEARS ARE DOWN AND LOCKED BEFORE REMOVING THE AIRPLANE FROM JACKS (AMM 7-10-00).**

**WARNING:** **AIRPLANES WITH ZERO FUEL AND EQUIPMENT REMOVED FROM THE FRONT MUST BE SUPPORTED BY A TAIL JACK OR LOADED FORWARD WITH SUITABLE BALLAST TO COMPENSATE FOR THE AFT C.G. CONDITION.**

**CAUTION:** **DURING ALL SERVICING OPERATIONS:**

- **MAKE SURE ALL LANDING GEAR LOCKING PINS ARE INSTALLED.**
- **MAKE SURE ALL RELEVANT FIRE PRECAUTIONS ARE OBSERVED.**
- **MAKE SURE ALL SERVICING EQUIPMENT IS CLEAR OF MOVABLE SURFACES, PARTICULARLY THE FLAPS.**
- **MAKE SURE THAT SERVICING EQUIPMENT WILL NOT FOUL WHEN AIRPLANE GROUND CLEARANCE IS REDUCED DURING REFUELLING.**
- **MAKE SURE AIRPLANE IS ELECTRICALLY SAFE.**

*NOTE: All servicing points are illustrated in (Figure 1). System pipelines are identified with markers as shown in (Figure 2).*


VENT COLLECTOR TANK DRAIN VALVE
ACCESS TO:- OXYGEN CHARGING POINT (MOD 252036)
FUEL TANK WATER DRAIN VALVES
ACCESS TO:- VENTRAL TANK FILLER CAP
REAR EQUIPMENT BAY ACCESS TO:- AIR CONDITIONING REFRIGERATION UNIT HYDRAULIC RESERVOIR AND ACCUMULATORS RUDDER BIAS WATER DRAINS BATTERIES
LEG CHARGING POINT
AIRFRAME DE-ICING TANK FILLING POINT
FUEL DRAIN VALVE
FUEL DRAIN VALVES
LEG CHARGING POINT
ACCESS TO:- WINDSCREEN DE-ICING TANK
STATIC SYSTEM WATER DRAINS
VENT COLLECTOR TANK DRAIN VALVE
NOSEWHEEL BAY ACCESS TO:- AUXILIARY HYDRAULIC TANK GROUND INTERCOMM POINT
FUEL FILLING POINT AND FUEL LEVELLING CONTROL LEVER
OIL FILLING POINT ACCESS THROUGH LOWER COWL
TOILET COMPARTMENT ACCESS TO:- WATER TANK FLUSHING TOILET
OIL FILLING POINT ACCESS THROUGH LOWER COWL
NOSE CONE: ACCESS TO OXYGEN CHARGING POINT (PRE-MOD 252036)
LEG CHARGING POINT
FUEL FILLING POINT AND FUEL LEVELLING CONTROL LEVER
V1339
HA00B985057AA

Servicing points

*Figure 1*

**Table 1 SERVICING POINT COUPLINGS**

| System coupling | Coupling type |
|---|---|
| ELECTRICAL SYSTEM<br>Ground supply<br>28-volts DC | Cannon plug GCB/3LV/14GB183 |
| HYDRAULIC SYSTEM<br>Accumulator charging point (Schrader) | 9/16 inch 18-UNF |
| LANDING GEAR<br>Leg inflation point (Schrader) | 9/16 inch 18-UNF |
| OXYGEN SYSTEM<br>Ground charging point | 3/8 inch 24-UNF-2B |
| INTERCOMMUNICATION<br>Ground intercomm | Jack box socket Marconi EJA 75C |

## 2. Use of Servicing mats

**CAUTION: BEFORE PLACING SERVICING MATS OVER WING SKINS MAKE SURE THAT SKINS ARE DRY AND MATS ARE NOT DAMP OR CONTAMINATED IN ANY WAY.**

**CAUTION: DO NOT LEAVE SERVICING MATS IN POSITION FOR LONGER THAN IS NECESSARY.**

**CAUTION: FAILURE TO OBSERVE THIS PRECAUTION COULD RESULT IN POSSIBLE SKIN CORROSION, PARTICULARLY ON UNPAINTED AREAS, AFTER ONE OR TWO HOURS CONTACT.**

### A. Wing skin protection mat - refuelling (Mod.252453GE)

A wing skin protection mat - Refuelling, is available under Mod.252453GE to protect the skin and leading edge from scratches through scuffing of the refuelling hose during fuel servicing. The mat, stowed in the rear equipment bay, is placed on the wing and over the leading edge in the area of the wing fuelling point.

## 3. Pipeline identification *(Figure 2)*

System pipelines are identified in accordance with international convention. The identification system comprises:

- Figure 2.A. - A symbol with title denoting function of pipe system.
- Figure 2.B. - A worded marker distinguishing two separate systems having a similar function.
- Figure 2.C. - A number identifying a particular pipe run throughout its length.
- Figure 2.D. - A skull and crossbones marker is put on pipes which could cause injury or damage if precautions to be taken before disconnecting such a pipe are not complied with

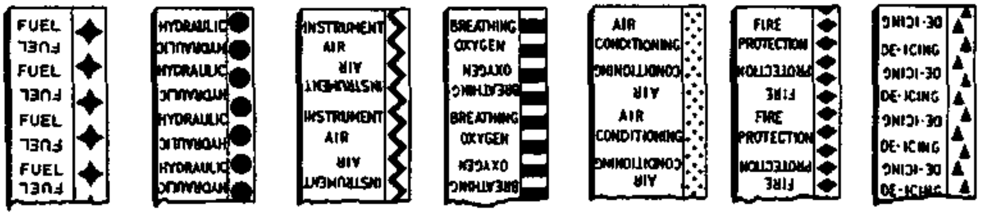


FIG 2.A. PIPE SYSTEM IDENTIFICATION

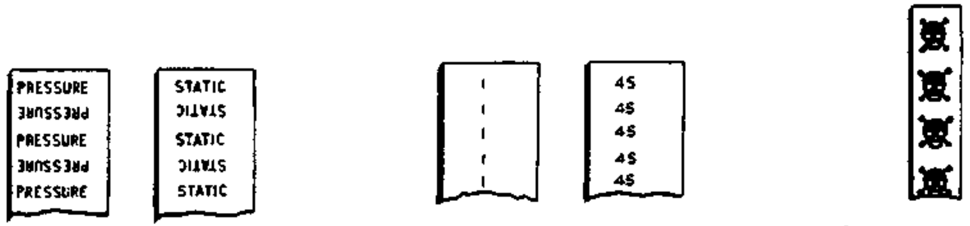


FIG 2.B. PIPE FUNCTION

FIG 2.C. PIPE RUN IDENTIFICATION NUMBER

FIG 2.D. WARNING LABEL

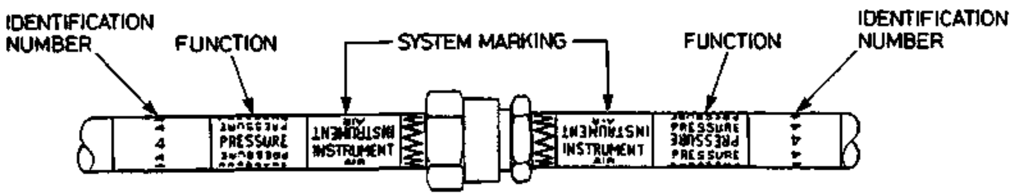


FIG 2.E. TYPICAL PIPE MARKING ARRANGEMENT

Pipeline identification
*Figure 2*

# SERVICING

## AILERON CONTROL CABLES - LUBRICATION

WARNING: WHEN HANDLING CONTROL CABLES, USE PROTECTIVE GLOVES. DO NOT MOVE THE AILERON CONTROLS WHEN GREASE IS APPLIED TO THE CONTROL CABLES.

### 1. Lubricate aileron control cable

Equipment/Materials:

| Equipment/Material | Item No./Source |
|---|---|
| Silicone grease | 046 (Ref.AMM 20-95-11) |
| Warning signs | Local |
| Lint-free cloth | Local |
| Gloves | Local |

### A. Lubrication procedure

NOTE: This procedure is applicable to the left and right aileron. Data for the right installation is given between brackets.

(1) Put up warning signs to tell persons: 'KEEP CLEAR OF THE AILERONS - FUNCTIONS IN PROGRESS'.

(2) In the left (right) main-gear wheel well, remove access panels W508 and W425 (W507 and W325) to gain access to the fuselage pressure seals.

(3) Operate the control column handwheel from full left aileron up to full right aileron up. Make temporary marks to show full range of movement of the aileron control cables through the fuselage pressure seals.

(4) Hold the control column handwheel in the full left aileron up position.

(5) Put silicon grease, Material No. 046, onto a clean lint-free cloth. Apply the silicon grease to both aileron cables over the range of travel visible.

(6) Move the control column handwheel to full right aileron up. Apply the silicon grease to both aileron cables over the range of travel visible.

(7) Operate the control column handwheel from full left aileron up to full right aileron up several times. Make sure the silicon grease completely covers the aileron cables through the full range of travel.

(8) Remove all unwanted silicon grease from the fuselage pressure seals.

(9) Repeat operations (2) to (8) for the right aileron installation.

(10) Remove all tools, materials and equipment from the work area. Make sure the area is clean.

(11) Install the access panels W508 and W425 (W507 and W325).

# AIR CONDITIONING - SERVICING

## 1. Refrigeration unit

### A. Recommended oils for cooling turbine

| Equipment/Materials | Part/Item No. |
|---|---|
| Engine oil | 137 (Chapter 20-95-101) |

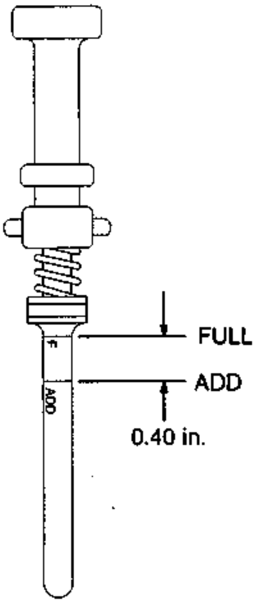
*NOTE: Garrett approved substitutes may be used for listed oils but do not mix oils of different specifications.*

### B. Check refrigeration unit cooling turbine oil level *(Figure 301)*

(1) Remove dipstick from cooling turbine and wipe clean.

(2) Insert dipstick and check that oil level is between the ADD mark on the dipstick and F above the ADD mark.

(3) Add oil, if necessary, through the dipstick opening, up to the F mark.



M1604/1
HA00B998183AA

Dipstick assembly
*Figure 301*

## SERVICING

## ELECTRICAL POWER

CAUTION : IF IT IS INTENDED TO PARK THE AIRCRAFT IN AMBIENT TEMPERATURES BELOW - 10°C FOR A PERIOD OF TWELVE HOURS OR MORE, THE AIRCRAFT BATTERIES MUST BE REMOVED TO A WARMER ENVIRONMENT.

### 1. General

Primary d.c. power distribution is effected by busbars designated PS1, PS2 and PE. During ground servicing, the busbars can be energized from the a.p.u. generator (if fitted) or ground supplies. PE busbar may also be energized from the aircraft batteries, provided their use is severely restricted. To energize the d.c. busbars refer to Fig.1.

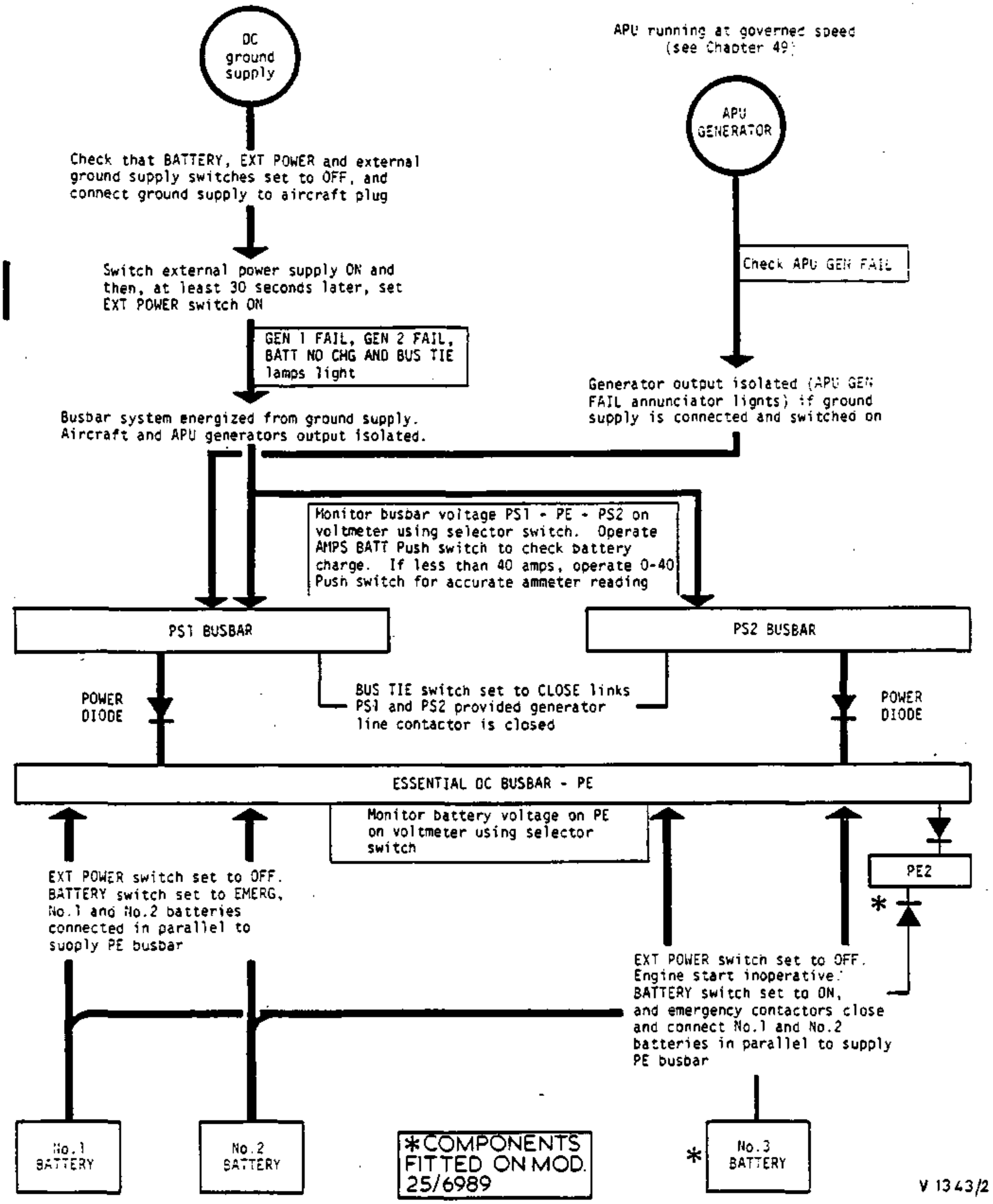
NOTES : (1) To avoid drain on aircraft batteries it is recommended that testing of electrical services be carried out using external ground supply incorporating overvoltage protection.

(2) An external ground supply when used for engine starting must be capable of producing 28 volts at up to 1000 amps load with negligible voltage drop and must also incorporate a current limiting device to operate at 1100 amps.

The external ground supplies are connected to the aircraft electrical system via a three pin plug located on the fuselage right-hand side.

Post Mod.256951, a ground power overvoltage protection unit is incorporated in the ground supply circuit. Should the protection unit sense an overvolting ground power supply it will operate to 'latch' out the aircraft ground supply contactor and isolate the ground supply from the aircraft busbars. To reset the latch and re-establish the ground supply, the control switch on the ground power unit must be set to 'off' and then 'on'.

Fig.1 on following page


DC ground supply
APU running at governed speed (see Chapter 49)
APU GENERATOR
Check that BATTERY, EXT POWER and external ground supply switches set to OFF, and connect ground supply to aircraft plug
Check APU GEN FAIL
Switch external power supply ON and then, at least 30 seconds later, set EXT POWER switch ON
GEN 1 FAIL, GEN 2 FAIL, BATT NO CHG AND BUS TIE lamps light
Generator output isolated (APU GEN FAIL annunciator lights) if ground supply is connected and switched on
Busbar system energized from ground supply. Aircraft and APU generators output isolated.
Monitor busbar voltage PS1 - PE - PS2 on voltmeter using selector switch. Operate AMPS BATT Push switch to check battery charge. If less than 40 amps, operate 0-40 Push switch for accurate ammeter reading
PS1 BUSBAR
PS2 BUSBAR
POWER DIODE
BUS TIE switch set to CLOSE links PS1 and PS2 provided generator line contactor is closed
POWER DIODE
ESSENTIAL DC BUSBAR - PE
Monitor battery voltage on PE on voltmeter using selector switch
PE2
*
EXT POWER switch set to OFF. BATTERY switch set to EMERG, No.1 and No.2 batteries connected in parallel to supply PE busbar
EXT POWER switch set to OFF. Engine start inoperative. BATTERY switch set to ON, and emergency contactors close and connect No.1 and No.2 batteries in parallel to supply PE busbar
No.1 BATTERY
No.2 BATTERY
*COMPONENTS FITTED ON MOD. 25/6989
* No.3 BATTERY
V 1343/2

DC busbar energization
Fig.2

* * *

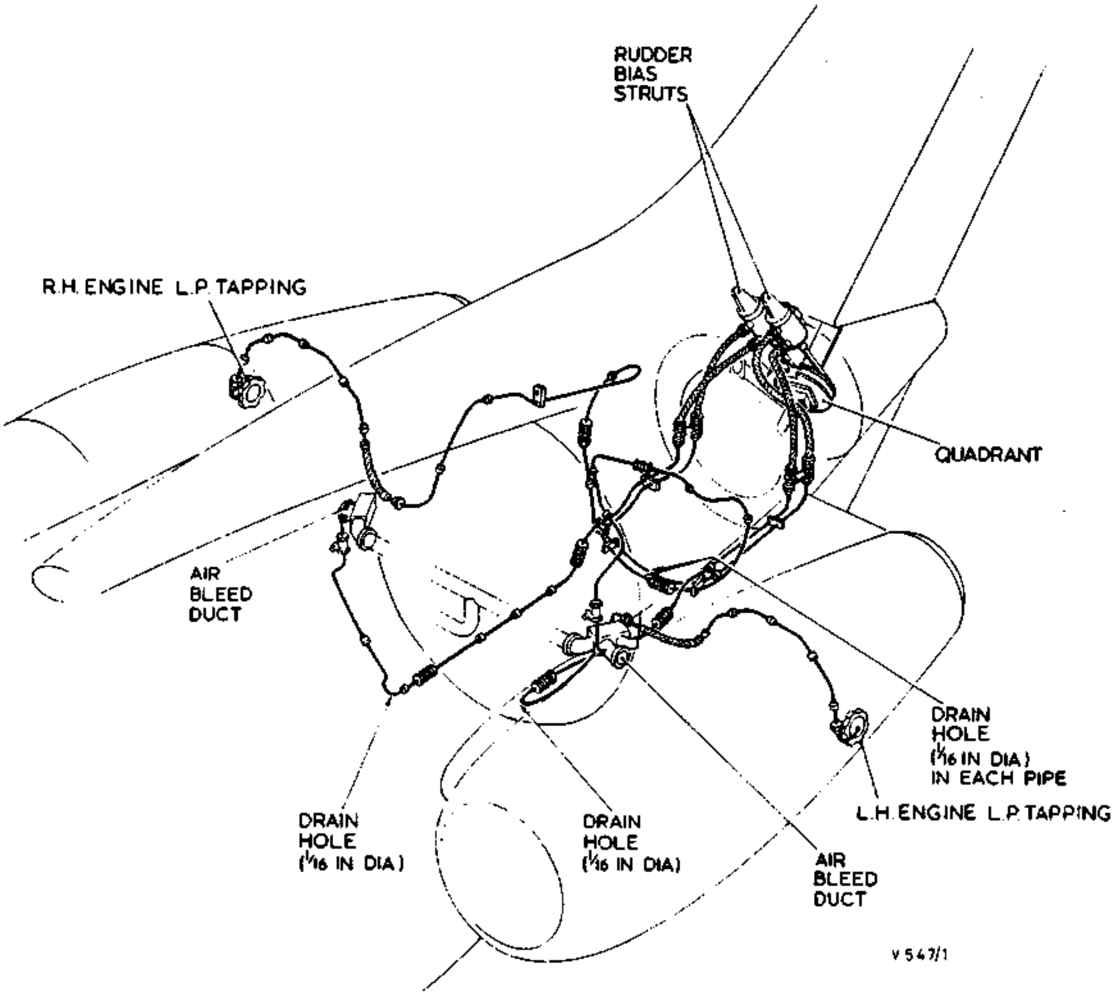
# SERVICING

## FLIGHT CONTROLS

### 1. Rudder bias system

#### A. Water drains

Ensure that drain holes are clear (Fig.1).



Water drains
Fig.1

* * *

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## 1. Approved fuels

Approved fuel specification

*Table 301*

Fuels with icing inhibitor added

| FUEL GRADE | NATO SYMBOL | USA CIVIL | USA MILITARY | GREAT BRITAIN | CANADA | FRANCE | ITALY | RUSSIA |
|---|---|---|---|---|---|---|---|---|
| JET A-1 KEROSENE TYPE | F-34 | – | MIL-T-83133 (JP-8) | DERD 2453 (AVTUR/ FS11) | CAN/CGSB 3.23 JET A-1 or F-34 | AIR3405 Grade F-34 | AER-M-C 141 F-34 | – |
| JET B WIDE CUT GASOLINE | F-40 | – | MIL-T-5624 (JP-4) | DERD 2454 (AVTAG/ FS11) | CAN/CGSB 3.22 JET B or F-40 | AIR3407 Grade F-40 | AER-M-C 142 F-40 | – |
| JET A KEROSENE TYPE | – | – | – | – | CAN/CGSB 3.23 JET A | – | – | – |

Fuels with no inhibitor added

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| JET A-1 KEROSENE TYPE | F-35 | ASTM D-1655 JET A-1 | – | DERD 2494 (AVTUR) | – | AIR3405 Grade F-35 | AER-M-C 141 F-35 | GOST-10227 -86 TS-1, T-1 & RT |
| JET B WIDE CUT GASOLINE SEE *NOTE* | – | ASTM D-1655 JET B | – | – | – | – | – | GOST-10227 -86 T-2 |
| JET A KEROSENE TYPE | – | ASTM D-1655 JET A | – | – | – | – | – | – |

*NOTE: Mod.252738 (both engines)*

### A. General

(1) The engines should be started and operated with fuel conforming to *Table 301* and the issues given in the Flight Manual.

(2) Mixing of the approved fuels in the specification is permitted.

(3) When the grade of fuel is changed, adjust the engine electronic fuel computer as necessary to correspond with the fuel being used.

(4) Any deviations to standard fuel specifications (e.g. increase in aromatic content, change of smoke point, seasonal variations in freeze point, etc.), shall be evaluated by the Garrett Turbine Engine Company and any clearance given will be separately published.

## 2. Approved additives for Kerosene fuels

### A. Antistatic

Dupont STADIS 450. May be used in concentrations not exceeding 3.0 parts per million (PPM).

SIGBOL TU38-101741-78. May be used in concentrations not exceeding 0.0005% by volume.

### B. Anti-icing and biocidal additives

For anti-icing and preventitive continuous biocidal treatment.

DEF STAN 68-252 (D.E.R.D. 2451 Issue 1 and Issue 2) MIL-1-27686-Normal, (Alternative - MIL-1-85470). May be used in concentrations not more than 0.15% by volume.

*NOTE: The additives mentioned in above should not be added to fuel specification DEF STAN 91-87 (D.E.R.D. 2453), MIL-T-5624 or MIL-T-83133 as they are already present in these fuels.*

TGF to GOST 17477-86, TGF(M) to TU 6-10-1457-79, I to GOST 8313-88, I(M) to TU 6-10-1458-79 can be used in concentrations not more than 0.3% by volume.

### C. Biocidal additives *(Table 302)*

**CAUTION: CONCENTRATIONS OF BIOBOR NOT EXCEEDING 270 PPM BY WEIGHT (20 PPM BORON) MAY BE USED FOR SHOCK TREATMENT ONLY. AFTER SHOCK TREATMENT THE ENGINE(S) MUST NOT BE RUN UNTIL THE TANK(S) HAVE BEEN DRAINED.**

**CAUTION: UNDER NO CIRCUMSTANCES MAY FUEL WITH CONCENTRATIONS OF BIOBOR IN EXCESS OF 135 PPM BY WEIGHT (10 PPM BORON) BE BURNT BY THE ENGINE(S).**

Biobor JF may be used as a preventative biocidal treatment at concentrations not exceeding 135 PPM by weight.

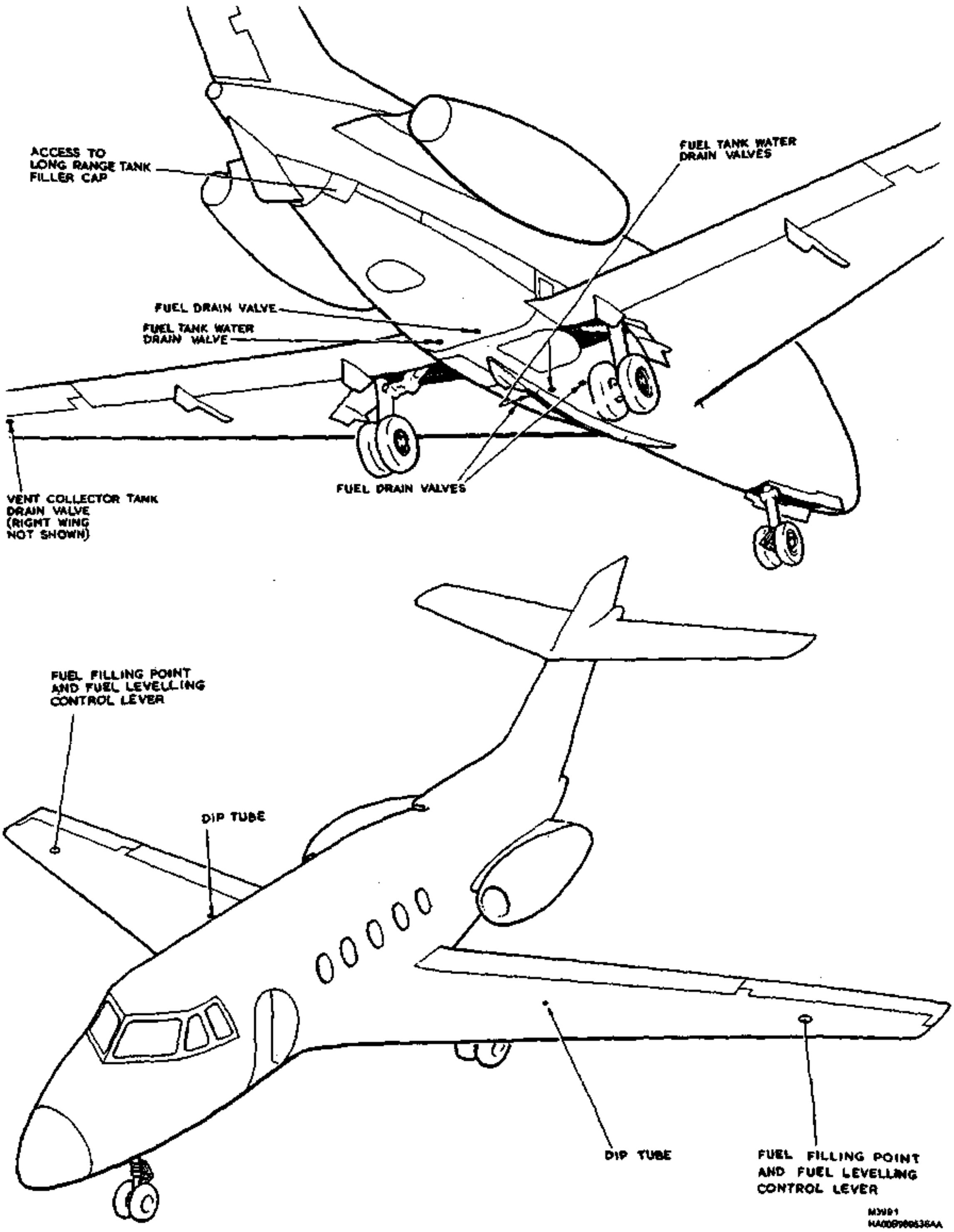
For biocidal shock treatment, Biobor JF may be added to fuel tanks at a concentration not exceeding 270 PPM by weight, provided it is subsequently off-loaded before engine start.

Biobor JF mixing quantities
*Table 302*

| 10,000 lb of Fuel at 0.8 SG | Preventative Treatment at 135 PPM Concentration | Shock Treatment at 270 PPM Concentration |
|---|---|---|
| 1,500 US gallons | 0.15 US gallons | 0.30 US gallons |
| 1,250 Imp gallons | 0.13 Imp gallons | 0.26 Imp gallons |
| 5,680 liters | 580 cc | 1,160 cc |

### D. Anti-corrosive additive DERD 2461, APL 2461, MIL-I-25017

May be used in concentrations permitted by the fuel specification.


ACCESS TO LONG RANGE TANK FILLER CAP
FUEL TANK WATER DRAIN VALVES
FUEL DRAIN VALVE
FUEL TANK WATER DRAIN VALVE
VENT COLLECTOR TANK DRAIN VALVE (RIGHT WING NOT SHOWN)
FUEL DRAIN VALVES
FUEL FILLING POINT AND FUEL LEVELLING CONTROL LEVER
DIP TUBE
DIP TUBE
FUEL FILLING POINT AND FUEL LEVELLING CONTROL LEVER
M3991

Fuel system servicing points.

*Figure 301*

## 3. Refuelling Procedure

### A. General

NOTE: *Contents indicators register usable fuel only.*

### B. Data

| Tank | Total fuel capacities | | | Usable Fuel Capacities | | |
|---|---|---|---|---|---|---|
| | U.S. Gal. | Imp. Gal. | Liters | U.S. Gal. | Imp. Gal. | Liters |
| Left Wing | 621.20 | 517.25 | 2351.30 | 512.50 | 512.50 | 2329.70 |
| Right Wing | 621.20 | 517.25 | 2351.30 | 512.50 | 512.50 | 2329.70 |
| Long Range | 135.00 | 112.70 | 512.30 | 134.50 | 112.00 | 509.10 |
| Totals | 1377.40 | 1147.20 | 5214.90 | 1365.30 | 1137.00 | 5168.50 |

Maximum refuelling rate per tank ........ 84 U.S. Gal. / min
........ 70 Imp. Gal. / min.
........ 318.20 Liters / min.

### C. Approved Fuel Specification

For approved fuel and additives specification, refer to paragraphs 1. and 2.

### D. Refuel Tanks. *(Figure 302, Figure 303 and Figure 304)*

NOTE: *Park the airplane on level ground or, if the ground slopes, then facing down the slope.*

(1) Do a check of the contents of each tank using flight compartment indicators or if airplane is level, dip tubes *(Figure 302)* and ascertain fuel load required. Refer to Tables 303 and 304.

NOTE: *If indicators in flight compartment are to be used, energize PE busbar, refer to Chapter 24, ELECTRICAL POWER, and do not use other electrical systems on the airplane at this time. Do not use battery for longer than necessary.*

(2) Drain all water from tanks. Refer to *(Figure 304).*

NOTE: *To drain water from the long range tank it is necessary to drain from both the water and the fuel drains.*

(3) Comply with the local refuelling safety precautions.

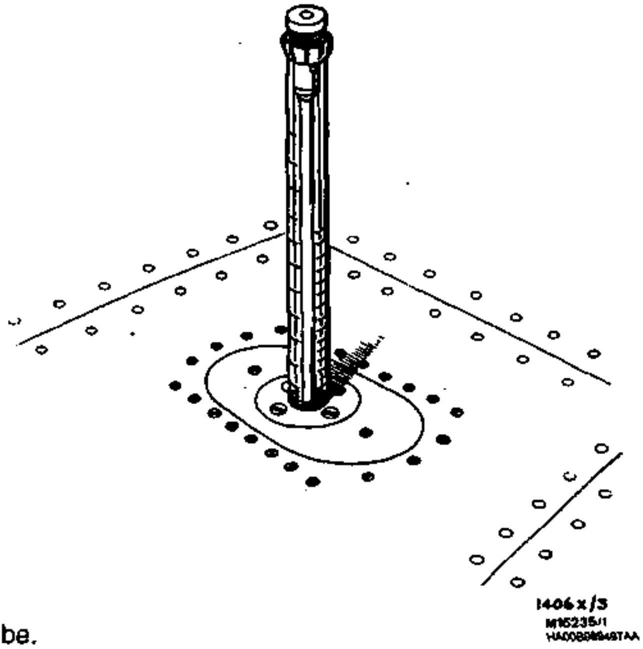
(4) Bond the tanker or hydrant to the airplane and to the ground.

(5) Place the wing skin protection mat(s) 25Y1793 (Mod.252453) on the wing at the filling point(s) and unlock and remove the filler cap *(Figure 303).*

NOTE: *Gain access to the long range tank filler via the hinged access panel.*

TO CHECK FUEL CONTENTS

1. DEPRESS PLUNGER IN TOP OF DIP TUBE AND HOLD FOR AT LEAST 10 SECONDS.
2. WITHDRAW DIP TUBE TO ITS FULL EXTENT AND CHECK FUEL CONTENTS.
3. IF DIP TUBE IS FULL, DEPRESS PLUNGER, ALLOW FUEL LEVEL IN DIP TUBE TO FALL AND CHECK LEVEL ON SECOND SCALE.
4. PUSH DIP TUBE INTO TANK AND APPLY LIGHT PRESSURE UNTIL SPRING LOCK ENGAGES



Dip tube.
*Figure 302*

(6) Bond filling nozzle to tank.

(7) Refuel as required. Refuel both wing tanks simultaneously if possible. Refuel wing tanks before long range tank.

NOTE: *Wing tanks are full when fuel level is 1.5in. (38mm.) below top skin at filler neck - DO NOT OVERFILL. The minimum recommended fuel load is 960 lb (435.4 kg). The maximum permissible out of balance between wing tanks for flight is 500 lb (226.7 kg).*

NOTE: *The long range tank contents indicator in the flight compartment registers 'FULL' 'cross-hatched' (i.e. not full but fuel in tanks) or 'EMPTY' when the busbars are energised.*

(8) Check load in tank as in paragraph 1.D. (1).

(9) Withdraw filling nozzle and disconnect bonding.

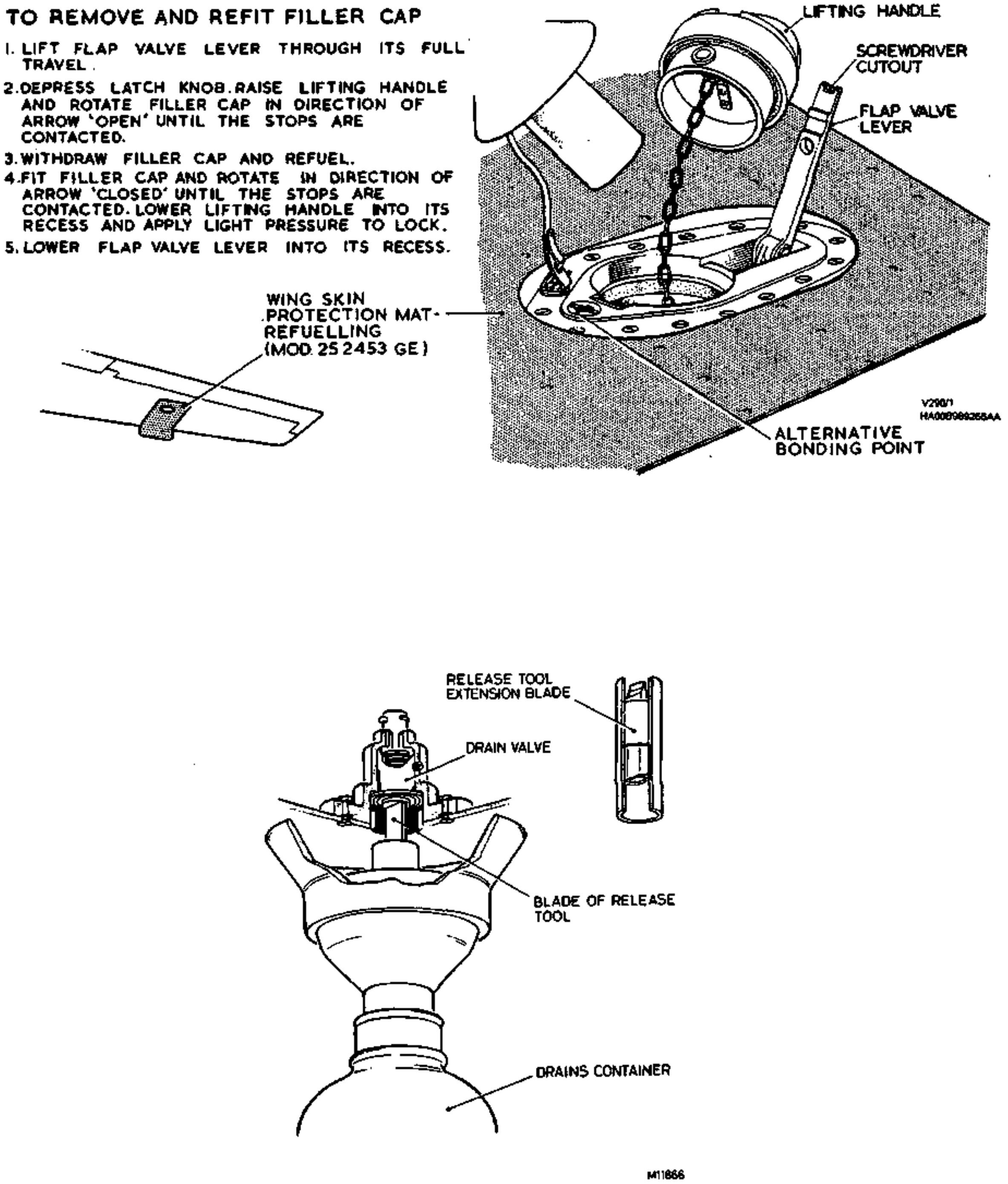
(10) Make sure each filler cap is serviceable then install and lock filler cap. Stow wing skin protection mat(s) in the rear equipment bay.

NOTE: *Close access panel over long range filler cap.*

(11) Disconnect bonding between tanker or hydrant and airplane.

(12) Drain all water from tanks *(Figure 304)*. Drain water from fuel drain on long range tank.

NOTE: *Free water readily separates from fuel but water in extremely fine droplets will remain suspended for at least 10 minutes. If the drained fuel sample appears cloudy, it contains water and further time is required to allow this water to settle.*



TO REMOVE AND REFIT FILLER CAP

1. LIFT FLAP VALVE LEVER THROUGH ITS FULL TRAVEL.
2. DEPRESS LATCH KNOB. RAISE LIFTING HANDLE AND ROTATE FILLER CAP IN DIRECTION OF ARROW 'OPEN' UNTIL THE STOPS ARE CONTACTED.
3. WITHDRAW FILLER CAP AND REFUEL.
4. FIT FILLER CAP AND ROTATE IN DIRECTION OF ARROW 'CLOSED' UNTIL THE STOPS ARE CONTACTED. LOWER LIFTING HANDLE INTO ITS RECESS AND APPLY LIGHT PRESSURE TO LOCK.
5. LOWER FLAP VALVE LEVER INTO ITS RECESS.

Wing tank filler cap.

*Figure 303*

(13) To drain water from the wing center tanks, use a release tool with extension blade:

   (a) Put the blade of the release tool in the slot of the drain valve spindle.

   (b) Turn the tool and the valve counter-clockwise one quarter turn and push up.

   (c) Drain until the drains container is seen to be full.

   (d) Release the pressure on the drains tool and let the drain move down to the closed position.

   (e) Turn the tool and the valve clockwise to lock the valve in position.

   (f) Examine the sample and do the drain procedure again, as necessary.

   (g) This tool can be used without the extension blade to drain the vent surge tanks and the ventral tank

**E. Defuel Tanks.** (*Figure 303, Figure 304*)

| Equipment/Material | Part/Item No. |
|---|---|
| Gravity defuelling drain adapter | 25Y867A (part of 25Y635A) |
| Suction defuelling drain adapter | 25Y635A or 25Y635A/B |

*NOTE: Fuel may be off-loaded by gravity into a container or by suction into a tanker or hydrant.*

(1) Ascertain fuel load required.

(2) Comply with the local refuelling safety precautions.

(3) Drain all water from tanks (*Figure 304*).

(4) Bond the tanker or hydrant to the airplane and to the ground.

(5) Place the wing skin protection mat(s) 25Y1793 (Mod.252453) on the wing at the filling point(s) and unlock and remove the filler cap (*Figure 303*).

(6) Unscrew blanking adaptor from fuel drain valve and install drain adaptor to tank.

   (a) For gravity defuelling, use adapter 25Y867A (part of 25Y635A or 25Y635A/B).

   (b) For suction defuelling, use adapter 25Y635A or 25Y635A/B.

   *NOTE: 25Y867A is a sub-assembly of 25Y635A and can be obtained separately.*

(7) Off load fuel as required from each tank.

(8) Remove drain adapter and install blanking adapter to fuel drain valve.

(9) Install filler cap(s) and lock *(Figure 303).* Stow wing skin protection mat(s) in the rear equipment bay.

Fuel specific gravity/pounds/Imperial gallons conversion table.

*Table 303.*

| S.G. | 1 lb | 2 lb | 3 lb | 4 lb | 5 lb | 6 lb | 7 lb | 8 lb | 9 lb |
|---|---|---|---|---|---|---|---|---|---|
| 0.7300 | 0.1370 | 0.2740 | 0.4110 | 0.5480 | 0.6850 | 0.8220 | 0.9590 | 1.0960 | 1.2330 |
| 0.7350 | 0.1361 | 0.2722 | 0.4083 | 0.5444 | 0.6805 | 0.8166 | 0.9527 | 1.0888 | 1.2249 |
| 0.7400 | 0.1351 | 0.2702 | 0.4053 | 0.5404 | 0.6755 | 0.8106 | 0.9457 | 1.0808 | 1.2159 |
| 0.7450 | 0.1342 | 0.2684 | 0.4026 | 0.5368 | 0.6710 | 0.8052 | 0.9394 | 1.0736 | 1.2078 |
| 0.7500 | 0.1333 | 0.2666 | 0.3999 | 0.5332 | 0.6665 | 0.7998 | 0.9331 | 1.0664 | 1.1997 |
| 0.7550 | 0.1325 | 0.2650 | 0.3975 | 0.5300 | 0.6625 | 0.7950 | 0.9275 | 1.0600 | 1.1925 |
| 0.7600 | 0.1316 | 0.2632 | 0.3948 | 0.5264 | 0.6580 | 0.7896 | 0.9212 | 1.0528 | 1.1844 |
| 0.7650 | 0.1307 | 0.2614 | 0.3921 | 0.5228 | 0.6535 | 0.7842 | 0.9149 | 1.0456 | 1.1763 |
| 0.7700 | 0.1299 | 0.2598 | 0.3897 | 0.5196 | 0.6495 | 0.7794 | 0.9093 | 1.0392 | 1.1691 |
| 0.7750 | 0.1290 | 0.2580 | 0.3870 | 0.5160 | 0.6450 | 0.7740 | 0.9030 | 1.0320 | 1.1610 |
| 0.7800 | 0.1282 | 0.2564 | 0.3846 | 0.5128 | 0.6410 | 0.7692 | 0.8974 | 1.0256 | 1.1538 |
| 0.7850 | 0.1274 | 0.2548 | 0.3822 | 0.5096 | 0.6370 | 0.7644 | 0.8918 | 1.0192 | 1.1466 |
| 0.7900 | 0.1266 | 0.2532 | 0.3798 | 0.5064 | 0.6330 | 0.7596 | 0.8862 | 1.0128 | 1.1394 |
| 0.7936 | 0.1260 | 0.2520 | 0.3780 | 0.5040 | 0.6300 | 0.7560 | 0.8820 | 1.0080 | 1.1340 |
| 0.7950 | 0.1258 | 0.2516 | 0.3774 | 0.5032 | 0.6290 | 0.7548 | 0.8806 | 1.0064 | 1.1322 |
| 0.8000 | 0.1250 | 0.2500 | 0.3750 | 0.5000 | 0.6250 | 0.7500 | 0.8750 | 1.0000 | 1.1250 |
| 0.8050 | 0.1242 | 0.2484 | 0.3726 | 0.4968 | 0.6210 | 0.7452 | 0.8694 | 0.9936 | 1.1178 |
| 0.8100 | 0.1235 | 0.2470 | 0.3705 | 0.4940 | 0.6175 | 0.7410 | 0.8645 | 0.9880 | 1.1115 |
| 0.8150 | 0.1227 | 0.2454 | 0.3681 | 0.4908 | 0.6135 | 0.7362 | 0.8589 | 0.9816 | 1.1043 |
| 0.8200 | 0.1220 | 0.2440 | 0.3660 | 0.4880 | 0.6100 | 0.7320 | 0.8540 | 0.9760 | 1.0980 |
| 0.8250 | 0.1212 | 0.2424 | 0.3636 | 0.4848 | 0.6060 | 0.7272 | 0.8484 | 0.9696 | 1.0908 |
| 0.8300 | 0.1205 | 0.2410 | 0.3615 | 0.4820 | 0.6025 | 0.7230 | 0.8435 | 0.9640 | 1.0845 |
| 0.8350 | 0.1198 | 0.2396 | 0.3594 | 0.4792 | 0.5990 | 0.7188 | 0.8386 | 0.9584 | 1.0782 |
| 0.8400 | 0.1190 | 0.2380 | 0.3570 | 0.4760 | 0.5950 | 0.7140 | 0.8330 | 0.9520 | 1.0710 |
| 0.8450 | 0.1183 | 0.2366 | 0.3549 | 0.4732 | 0.5915 | 0.7098 | 0.8281 | 0.9464 | 1.0647 |
| 0.8500 | 0.1176 | 0.2352 | 0.3528 | 0.4704 | 0.5880 | 0.7056 | 0.8232 | 0.9408 | 1.0584 |
| 0.8550 | 0.1170 | 0.2340 | 0.3510 | 0.4680 | 0.5850 | 0.7020 | 0.8190 | 0.9360 | 1.0530 |
| 0.8600 | 0.1163 | 0.2326 | 0.3489 | 0.4652 | 0.5815 | 0.6978 | 0.8141 | 0.9304 | 1.0467 |

Fuel specific gravity/pounds/U.S. gallons conversion table.

*Table 304.*

| S.G. | 1 lb | 2 lb | 3 lb | 4 lb | 5 lb | 6 lb | 7 lb | 8 lb | 9 lb |
|---|---|---|---|---|---|---|---|---|---|
| 0.7300 | 0.1645 | 0.3290 | 0.4936 | 0.6581 | 0.8227 | 0.9872 | 1.1517 | 1.3162 | 1.4808 |
| 0.7350 | 0.1633 | 0.3269 | 0.4904 | 0.6538 | 0.8172 | 0.9807 | 1.1441 | 1.3076 | 1.4711 |
| 0.7400 | 0.1622 | 0.3245 | 0.4868 | 0.6490 | 0.8112 | 0.9735 | 1.1357 | 1.2980 | 1.4602 |
| 0.7450 | 0.1612 | 0.3223 | 0.4835 | 0.6446 | 0.8058 | 0.9670 | 1.1282 | 1.2893 | 1.4505 |
| 0.7500 | 0.1601 | 0.3202 | 0.4803 | 0.6403 | 0.8004 | 0.9608 | 1.1206 | 1.2807 | 1.4408 |
| 0.7550 | 0.1591 | 0.3183 | 0.4773 | 0.6365 | 0.7956 | 0.9547 | 1.1139 | 1.2730 | 1.4321 |
| 0.7600 | 0.1581 | 0.3161 | 0.4741 | 0.6322 | 0.7902 | 0.9483 | 1.1063 | 1.2644 | 1.4224 |
| 0.7650 | 0.1570 | 0.3139 | 0.4709 | 0.6278 | 0.7848 | 0.9418 | 1.0987 | 1.2557 | 1.4127 |
| 0.7700 | 0.1560 | 0.3120 | 0.4680 | 0.6240 | 0.7800 | 0.9360 | 1.0920 | 1.2480 | 1.4040 |
| 0.7750 | 0.1549 | 0.3099 | 0.4647 | 0.6197 | 0.7746 | 0.9295 | 1.0845 | 1.2394 | 1.3943 |
| 0.7800 | 0.1540 | 0.3079 | 0.4619 | 0.6158 | 0.7698 | 0.9238 | 1.0777 | 1.2317 | 1.3857 |
| 0.7850 | 0.1530 | 0.3060 | 0.4590 | 0.6120 | 0.7650 | 0.9180 | 1.0710 | 1.2240 | 1.3770 |
| 0.7900 | 0.1520 | 0.3041 | 0.4561 | 0.6081 | 0.7602 | 0.9122 | 1.0643 | 1.2163 | 1.3684 |
| 0.7936 | 0.1513 | 0.3027 | 0.4539 | 0.6053 | 0.7566 | 0.9079 | 1.0592 | 1.2106 | 1.3619 |
| 0.7950 | 0.1511 | 0.3022 | 0.4532 | 0.6043 | 0.7554 | 0.9065 | 1.0576 | 1.2086 | 1.3597 |
| 0.8000 | 0.1501 | 0.3003 | 0.4503 | 0.6005 | 0.7506 | 0.9007 | 1.0508 | 1.2010 | 1.3511 |
| 0.8050 | 0.1492 | 0.2983 | 0.4474 | 0.5966 | 0.7458 | 0.8949 | 1.0441 | 1.1933 | 1.3424 |
| 0.8100 | 0.1483 | 0.2966 | 0.4449 | 0.5932 | 0.7416 | 0.8899 | 1.0382 | 1.1865 | 1.3349 |
| 0.8150 | 0.1474 | 0.2947 | 0.4420 | 0.5894 | 0.7368 | 0.8841 | 1.0315 | 1.1789 | 1.3262 |
| 0.8200 | 0.1465 | 0.2930 | 0.4395 | 0.5860 | 0.7326 | 0.8791 | 1.0256 | 1.1721 | 1.3186 |
| 0.8250 | 0.1456 | 0.2911 | 0.4366 | 0.5822 | 0.7278 | 0.8733 | 1.0189 | 1.1644 | 1.3100 |
| 0.8300 | 0.1447 | 0.2894 | 0.4341 | 0.5788 | 0.7236 | 0.8683 | 1.0130 | 1.1577 | 1.3024 |
| 0.8350 | 0.1439 | 0.2878 | 0.4316 | 0.5755 | 0.7193 | 0.8632 | 1.0071 | 1.1510 | 1.2949 |
| 0.8400 | 0.1429 | 0.2858 | 0.4287 | 0.5716 | 0.7145 | 0.8575 | 1.0004 | 1.1433 | 1.2862 |
| 0.8450 | 0.1421 | 0.2842 | 0.4262 | 0.5683 | 0.7103 | 0.8524 | 0.9945 | 1.1366 | 1.2787 |
| 0.8500 | 0.1412 | 0.2825 | 0.4237 | 0.5649 | 0.7061 | 0.8474 | 0.9886 | 1.1299 | 1.2711 |
| 0.8550 | 0.1405 | 0.2810 | 0.4215 | 0.5620 | 0.7025 | 0.8431 | 0.9836 | 1.1241 | 1.2646 |
| 0.8600 | 0.1397 | 0.2794 | 0.4190 | 0.5587 | 0.6983 | 0.8380 | 0.9777 | 1.1174 | 1.2570 |

## SERVICING
## HYDRAULIC

### 1. General

Tank capacity :

| | | |
|---|---|---|
| Main system | .. | 2 Imp. gallons; 2.4 U.S. gallons; 9.1 litres |
| Auxiliary system | .. | 5 Imp. pints; 0.75 U.S. gallons; 2.84 litres |
| Fluid | .. | DEF-STAN 91-48/1 Grade superclean (MIL-H-5606) or normal. |

Equipment required :

| | |
|---|---|
| Spanner, reservoir filler cap removal | BAe 25Y189A |
| Torch | |

### 2. System servicing

#### A. Check main system reservoir contents

(1) Ensure landing gear - DOWN, flaps - UP and airbrakes SHUT.

(2) In conjunction with the accumulator pressure indicators, check fluid level of reservoir in level indicator tube against appropriate markings on adjacent label.

NOTE : To prevent a possible misreading, shine a torch from behind the indicator tube.

#### B. Replenish main system reservoir

CAUTION : BEFORE REPLENISHING, ENSURE THAT FILTER IN FILLER NECK IS IN POSITION AND UNDAMAGED. ALWAYS USE CLEAN OIL.

(1) Slowly remove reservoir filler cap and replenish reservoir as necessary.

(2) Check contents.

(3) Check that pressure release hole in filler cap is unobstructed and that the sealing ring is undamaged and correctly seated. Screw on filler cap.

(4) Clean off any spilt fluid.

#### C. Replenish auxiliary tank

CAUTION : BEFORE REPLENISHING, ENSURE THAT FILTER IN FILLER NECK IS IN POSITION AND UNDAMAGED. ALWAYS USE CLEAN OIL.

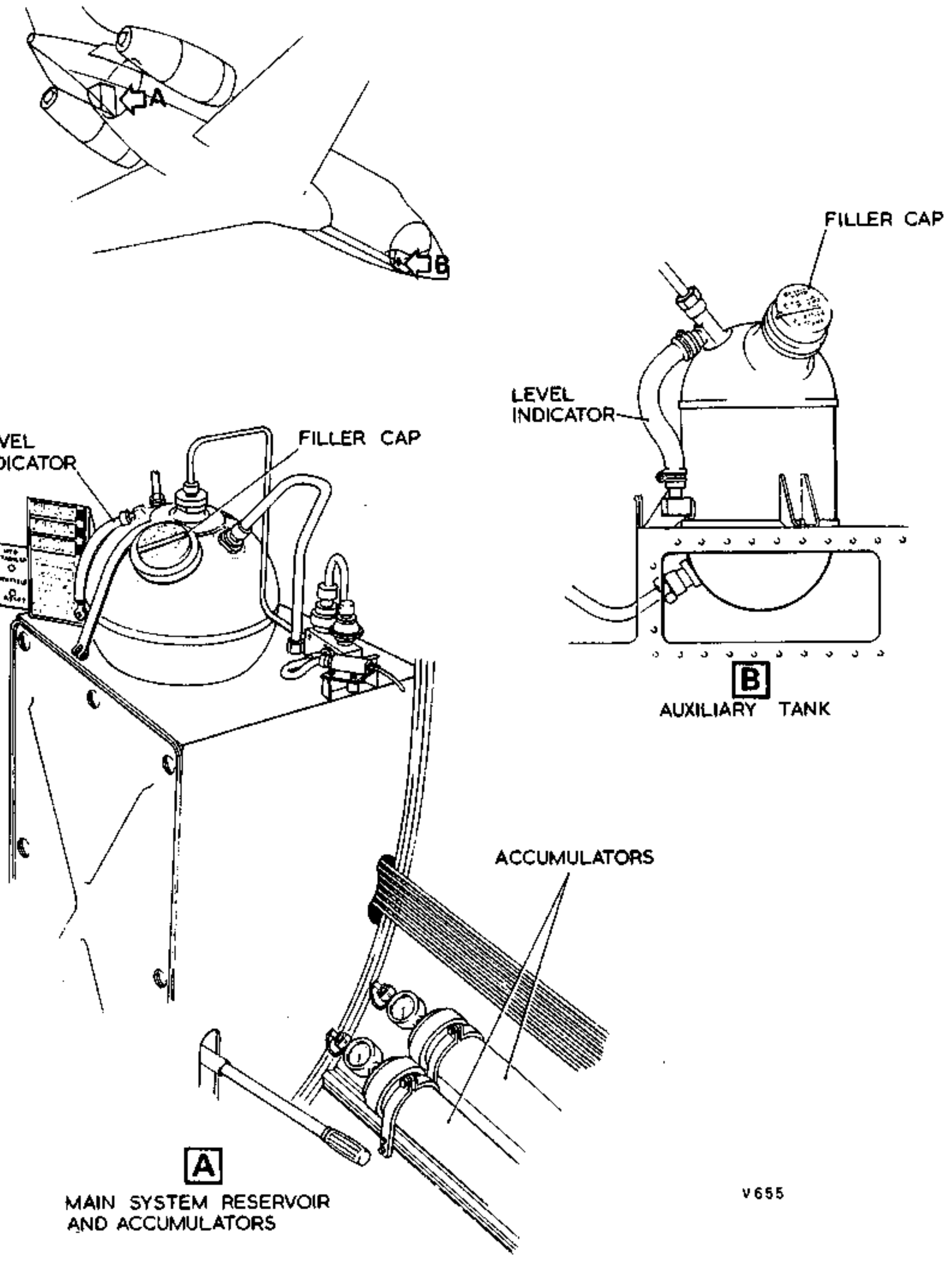
(1) Check fluid level in tank level indicator tube, and replenish tank as necessary.

NOTE : To prevent a possible misreading, shine a torch from behind the indicator tube.

(2) To replenish tank, remove filler cap and replenish tank until fluid is visible in filler neck and rises to top of level indicator tube. Check that sealing ring on filler neck is undamaged and correctly seated; screw on filler cap, and wire-lock

(3) Energize busbar PE (see Chapter 24, GENERAL) and check that AUX HYD LO LEVEL annunciator on MWS panel does not light. De-energize busbar PE.

...Hydraulic - Servicing continued



Hydraulic servicing points
Fig.1

* * *

# ICE AND RAIN PROTECTION - SERVICING

## 1. Airframe de-icing system

| Equipment/Material | Part/Item No. |
|---|---|
| Tank capacity (Airframe) | 3.3 U.S. gallons (2.75 Imp.gallons, 12.5 liters)<br>1.2 U.S. gallons (1.0 Imp.gallons, 4.55 liters) in a separate container. |
| Windshield system | 1.35 U.S. gallons (9 pints, 5.1 liters) |
| Fluid type or approved fluids (Airframe) | 101 (Chapter 20-95-101) |
| Tank capacity (Fuel filter and windshield system) | 1.35 U.S. gallons (9 Imp.pints, 5.1 liters) |
| Fluid type (Fuel filter and windshield system) | 239 (Chapter 20-95-201) or 239 mixed with 0.5% volume of 204 (Chapter 20-95-201) |

### A. Replenish airframe system tank *(Figure 301)*

(1) Make sure system is fully primed by doing paragraph 1.B.

(2) Energize D.C. busbars (Chapter 24, GENERAL).

(3) Check tank content from gauge on pilot's bulkhead.

(4) Remove filler cap and, with reference to gauge, replenish tank. View through filler neck and check that tank is full.

*NOTE: The replenishing fluid should not be below 0°C (32°F).*

(5) Check that filler cap washer is serviceable, install and tighten filler cap.

(6) Clean off any spilt fluid.

(7) De-energize D.C. busbars (Chapter 24 - GENERAL).

(8) If carried, make sure one-gallon container is full.

### B. Prime airplane system

(1) Energize D.C. busbars (Chapter 24 - GENERAL).

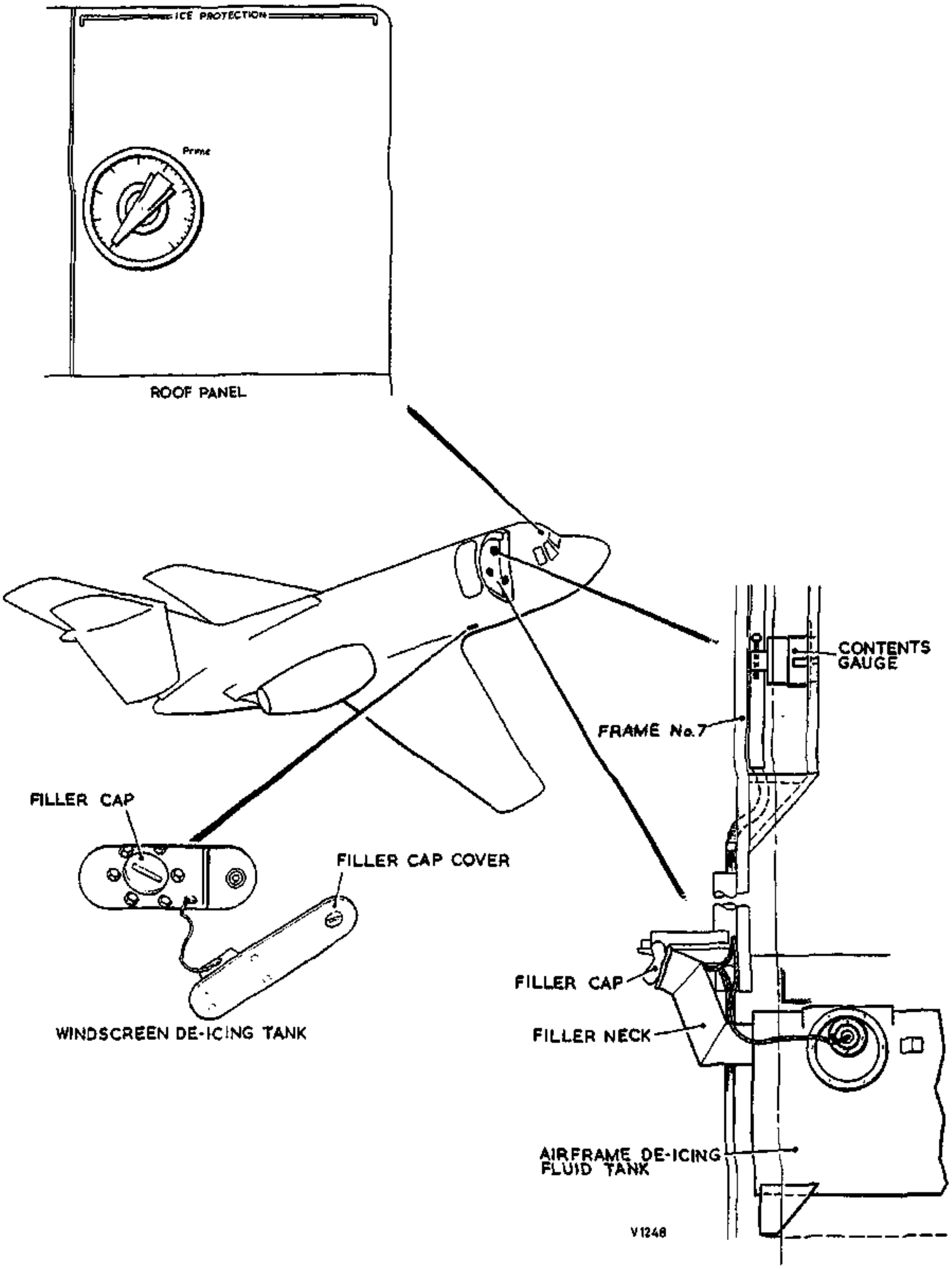
(2) On the contents gauge on pilots' RH console, make sure that at least one gallon of fluid is in the tank.

(3) Rotate time switch, labelled PRIME, on roof panel CG to its stop.

(4) Wait until time switch runs down (approx. 8 minutes) when the airplane system will be fully primed.

(5) De-energize D.C. busbars.

(6) Replenish airframe system tank (Paragraph A.).



De-icing servicing points
*Figure 301*

| | |
|---|---|
| **Manual Affected:** | DH 125 Series 400A (Mod. 252550) Aircraft Maintenance Manual (MM 125-F400AGV1-V2). |
| **Instructions:** | Insert this Temporary Revision (TR) before page 303, Chapter 12-30-00. This TR completely replaces all information from paragraph 2. Remove hoar frost, snow or ice from standing airplanes to the end of Chapter 12-30-00, page block 301. |
| **Reason:** | Provides additional instructions on the application of de-ice/anti-ice fluids and the removal of thickened residue that may result from using these fluids. |

## 2. DE-ICING AND ANTI-ICING OF AIRPLANES ON THE GROUND

### A. Information

| Equipment/Material | Part/Item No. |
|---|---|
| Power operated defrosting plant trolley, of adequate fluid capacity, capable of delivering heated fluid, and equipped with spray lances. | Local Supply |
| Ground servicing stands, to enable an operator to direct the spray down onto the aerofoil surfaces. | Local Supply |

(1) De-icing is the removal of ice, frost and snow from the airplane's exterior after it has formed. Anti-icing is a means of keeping the surface clear of subsequent accumulations of ice, snow and frost.

(2) Snow and ice on an airplane will seriously affect its performance. Even formation of a smooth covering of ice on the wing will change the contour of the wing, producing an increase in drag and a reduction in effective lift coefficient. Frost or frozen snow may present an even greater hazard since the surface texture is rough and will seriously disrupt the smooth flow of air across the wing.

### B. De-icing and Anti-icing Fluids

(1) Hawker Beechcraft Corporation has evaluated and approved the following de-ice/anti-ice fluids for use on this model:

(a) SAE Type I Anti-icing Fluids (Unthickened-Type Fluids)

Type I fluids (103a, Chapter 20-95-101) mainly provide protection against refreezing when there is no precipitation.

(b) SAE Type II Anti-icing Fluids (Thickened-Type Fluids)

Type II fluids (103b, Chapter 20-95-101) provide protection against refreezing when precipitation occurs.

(c) SAE Type III Anti-icing Fluids (Thickened-Type Fluids)

Type III fluids (103d, Chapter 20-95-101) provide protection against refreezing when precipitation occurs

(d) SAE Type IV Anti-icing Fluids (Thickened-Type Fluids)

Type IV fluids (103c, Chapter 20-95-101) provide protection against refreezing when precipitation occurs.

All approved Type I, Type II, Type III and Type IV fluids may be used for either de-icing or anti-icing at any dilution as allowed by the fluid manufacturer's recommendations.

Hawker Beechcraft Corporation cannot accept responsibility for damage to the airplane finish, windows, rubber seals, etc. resulting from the use of de-icing fluids not conforming to the specified specifications.

These fluids were chosen according to the following specifics:

1 Noncorrosive.

2 Do not deteriorate rubber, painted surfaces, or plastics.

3 Have a high flash point.

4 Nontoxic.

5 Good self-wetting and antifoaming characteristics.

## C. Remove Frost, Snow or Ice

**WARNING: Remove all snow, ice and frost before flight.**

**Type I, Type II, Type III and Type IV; Glycols are listed in the ‘harmful’ category. You must wear protective goggles, protective gloves and clothing when you handle this material. Keep the material away from skin and eyes.**

**Inhalation of glycol mists, aerosols, or high concentration of heated vapors poses a hazard to humans. Apply deicing fluid only in well-ventilated areas. Avoid inhaling vapors or mists. If adequate ventilation, designed to keep mists or vapors below harmful levels, is not available, maintenance personnel must wear approved respiratory protective devices.**

**De-icing fluid Type I, has a limited period of effectiveness (referred to as ‘Holdover Times (HOT)’). The use of Type I fluid should only be considered where Type II, Type III or Type IV fluids are not available.**

***CAUTION:*** *Make sure that the correct fluid application equipment and correct procedures are used by qualified personnel so that the fluid will perform to the specifications.*

*Fluid failure is complex and dependent on:*

- *Percent mix*
- *Type and rate of precipitation*
- *Product Holdover Time (HOT), and other variables*

*Each product is unique and reference must be made to the manufacturers recommendations and the FAA guidelines which are published each year.*

*Though these fluids pass the DTD crazing test for transparent panels, do not apply hot spray directly onto window panels or seals as damage may occur.*

*The fluids identified in this procedure are for ground de-icing/anti-icing only and are not intended for and do not provide protection during flight.*

*Residue from thickened de-icing/anti-icing fluids (Type ll, Type III or Type IV) can remain in aerodynamically quiet areas and accumulate over time. This residue can re-hydrate and expand into a gel-like material that could freeze during flight and cause restrictions in the flight control systems. The accumulation of residual fluid is more prevalent when using a one-step de-icing/anti-icing process which is commonly used in Europe.*

*For operators using the one-step application process, visually inspect flight control systems for the presence of dry or re-hydrated fluid at least twice during the winter operations season.*

*For operators using the two-step application process, visually inspect flight control systems for the presence of dry or re-hydrated fluid once at the end of the winter operations season, as a recommended minimum procedure.*

*Each operator must determine their own frequency of inspection based on the operational tempo of their airplane or fleet. For additional information concerning this guidance please contact the HBC field service representative or the Technical Support telephone line.*

## D. Guidelines to Holdover Times (HOT)

(1) Visit FAA web site (www.faa.gov) and in the search field type [Holdover Time Tables] and press go/search. A listing will be called up that will include (but is not limited to) documents that read “FAA - Approved de-icing Program Updates” for the current year. When the Web Site cannot be accessed or questions arise, contact FAA Flight Standards, Washington DC at 202.267.8166 or Hawker Beechcraft Corporation 1.800.429.5372 or 316.676.3140.

(2) Before take-off the pilot in command must be satisfied the airplane is clear of frost, snow or ice, within the limitations stated in the applicable Aircraft Flight Manual.

(3) If the holdover time is exceeded and visual/tactile investigation of flight surfaces is not possible, then the airplane should be returned for further treatment with de-icing/anti-icing fluid prior to takeoff.

(4) Freezing point of SAE/ISO Type I fluid mixture used must be at a minimum of 10°C (18°F) below OAT.

## E. General Application

**WARNING: Make sure the airplane is grounded before any work is started.**

**While these procedures are done, the surfaces will be very slippery due to snow, ice, or de-icing/anti-icing fluid; use a servicing stand whenever possible. If a stand is not available, use mainplane mats, safety belts, and take other similar precautions. Always stand upwind of the airplane.**

**De-icing/anti-icing fluids are toxic. Avoid contact with skin and eyes, use goggles and protective clothing.**

**Functional check of flight controls - If an airplane has been extremely iced or snow covered, a flight control check should be done. This check should be repeated after de-icing.**

***CAUTION:*** *Wing skin temperatures may differ and in some instances be lower than the OAT. A stronger mix (more glycol) can be used under these conditions.*

*The de-icing/anti-icing fluid used must be to a concentration and at a temperature in accordance with the fluid manufacturer's instructions, provided the following limitations are not exceeded:*

- *For heated fluids, a temperature of 60° C (140° F) at the nozzle is desirable. The upper temperature limit shall not exceed fluid and airplane manufacturer's recommendations.*
- *Before you apply fluid, ground the airplane and make sure the covers and blanks are installed to the equipment that follows:*

  *- Static vents*

  *- Pitot heads*

  *- Stall detector vanes*

*To prevent possible ingestion of de-icing fluid, do not operate the engines or APU (if applicable) while de-icing is in progress.*

*After snow is cleared from the surfaces, make sure the areas listed below are free from snow or ice:*

*- All air intakes*

*- Control surface hinges*

*- Gaps between wing trailing edge shroud and flaps, airbrakes and ailerons*

*- Gaps between horizontal stabilizer and elevators*

*- Gaps between rudder and vertical stabilizer*

*- Wheel brakes*

*- Landing gear bays*

*- All doors and external drains*

*- Cold air unit ram air exhaust outlet and duct*

*The directions given in the fluid manufacturer's instructions with reference to the possibility of mixing UCAR ULTRA with the residues of other fluids must be strictly adhered to. Minor contamination with Type I fluids can significantly degrade the anti-icing performance.*

## F. Remove Frost

(1) Spray with de-icing/anti-icing fluid to fluid manufacturer's instructions.

(2) Under severe frost forming conditions, after defrosting, give a further light application of the concentrated fluid to make sure the maximum holdover period.

## G. Remove Sleet and Freezing Rain

***CAUTION:*** *After spraying, examine surface thoroughly, as ice formed by freezing rain can be difficult to see under the de-icing fluid and may require touch for confirmation.*

- Spray with undiluted de-icing/anti-icing fluid.

## H. Remove Snow

(1) Dry snow

(a) Remove by brushing, or by the application of a cold air blast, taking care not to trap the snow in the control surface gaps and hinges.

(b) If the ambient temperature is above freezing, the snow can be removed by the application of a hot air blast, and the cleared surface sprayed with diluted de-icing/anti-icing fluid.

(2) Wet snow

(a) Remove with rubber squeegees, taking care not to trap the snow in the control surface gaps and hinges.

(b) If ice has formed under the snow, clear by spraying with de-icing/anti-icing fluid.

(3) Frozen snow and ice films

(a) Clear off any loose snow, then apply a heavy spray of de-icing/anti-icing fluid to the manufacturer's instructions.

- Brush the snow as the fluid is being applied; this will assist in breaking up the deposit and help to retain the fluid on the deposit. When all frozen deposits have been removed, give a final light spray.

(b) If the ambient temperature is above 0°C (32°F), ducted hot air blasts may be used to disperse the ice.

- Do not use hot air blasts near windows, and take extreme care to prevent damage by overheating to painted surfaces, rubber, glass, acrylic or glass fibre, hydraulic pipelines, grease or oiled surfaces
- Brush off or mop up water resulting from melted ice, as soon as possible.

## I. De-ice the Windshield

- Lightly spray windshield with fluid, windshield washing (DTD.900AA/4939A). If smearing occurs, wipe clear using a warm damp rag.

## J. De-ice the Landing Gear

***CAUTION:*** *De-icing/anti-icing fluid must not come into contact with landing gear electrical plugs and harnesses.*

*Do not let de-icing/anti-icing fluid contact brake units.*

(1) Brush-off loose accumulations of snow with soft brush.

(2) Remove stubborn deposits with a rag soaked in de-icing/anti-icing fluid.

## K. Anti-icing

- If meteorological reports predict the onset of freezing rain or heavy frost deposits, an anti-icing spray of cold (or hot if cold not available) concentrated ground de-icing/anti-icing fluid Type II, Type III or Type IV, will give limited holdover protection times, guidance for which is contained in Web Site mentioned in paragraph GUIDELINES TO HOLDOVER TIMES (HOT). If the precipitation is extremely heavy, deposits will form on top of the coating, but these will have little, if any, adhesion to the surfaces and can be easily removed with a light spray of hot diluted fluid.

## L. Fluid Spills

Glycol-based deicing fluids are biodegradable in water. Only gross contamination of slow moving or restricted bodies of water would be likely to cause any serious environmental impact. Typical field-use concentrations of deicing fluids, particularly when diluted by snow, ice or water, causes little or no injury to most broad leaf plants, grasses perennial ground cover, and woody plants.

Minor leaks or spills of deicing fluid in storage areas must be soaked up with an absorbent material, such as sawdust, vermiculite, an all-purpose commercial oil absorbent, or sand. Carefully shovel the absorbent/deicing fluid into an appropriate container for disposal.

Spilled, leaked, or contaminated deicing fluid must be disposed of in strict compliance with all applicable federal, state, and local regulations and ordinances.

## M. Remove Salt or Chemical Agents

***CAUTION:*** *Do not use high pressure water; damage may result to electrical equipment and lubricated components.*

(1) Where contamination has occurred on the structure, due to the airplane landing on airfields where the snow or ice has been dispersed with salt or chemical melting agents:

   (a) Wash down the affected areas with clean water as soon as possible. A wetting agent, such as detergent cleaner (Teepol TS610) or Comprex A, may be added in small quantities.

   (b) When the time or conditions prevent removal of the contamination at outstations, this must be noted in the technical log, so that appropriate action may be taken to remove it at main base.

## N. Residue from De-ice/Anti-ice

(1) Inspection

(a) Gain access to areas, potentially affected by residue, where flight controls and other systems components are located.

(b) Visually inspect for the presence of dry or rehydrated residue anywhere in these areas. The residue may be difficult to see, especially if dry. Dry residue tends to be in the form of a thin film that may be partially covered with grease or dirt. Rehydrated residue often appears as a gel-like substance which is thicker and therefore more visible.

(2) Cleaning

(a) After identifying any residue it should be removed by using warm water with rags and/or soft bristle brushes to clean the gel-like material away.

***CAUTION:*** *Make sure the water or compressed air does not cause any residue to enter areas that are not accessible. Do not allow runoff from the cleaning process to enter other areas of the airplane.*

*Avoid spraying cleaning fluids onto bearings, fittings, control cables and electrical connectors.*

*Do not spray controls with water if the ambient temperature is below freezing unless the airplane is located in a heated hangar.*

*This cleaning process can, potentially, remove grease from control system bearings and fittings, and remove corrosion inhibitors from control cables.*

(b) The use of a low-pressure stream of water or compressed air to rinse away any residue may prove helpful. Using Type I de-icing fluid, or a mixture of water and Type I fluid, is also a good cleaning agent for removal of residue.

(3) Relubrication (if required)

- If residue has been found and removed by cleaning, it is recommended that all bearings, fittings, and control cables in the affected area be relubricated (Refer to the appropriate chapter for relubrication of the affected area or areas).

**C. Replenish windshield system tank**

| Equipment/Material | Part/Item No. |
|---|---|
| Spanner, filler cap removal | BAe 25Y189A |

(1) Remove access panel from wing-root fairing.

(2) Unscrew de-icing tank filler cap.

(3) Check level of de-icing fluid. De-icing tank is full when fluid is visible in filler neck.

(4) Replenish tank as necessary

(5) Install tank filler cap. Clean off spilt fluid.

(6) Install access panel in wing-root fairing.

## 2. Remove hoar frost, snow or ice from standing airplane.

**WARNING: REMOVE ALL SNOW, ICE AND HOAR FROST BEFORE FLIGHT.**

**A. Equipment required:**

| Equipment/Material | Part/Item No. |
|---|---|
| Power operated defrosting plant trolley, of adequate fluid capacity, capable of delivering heated fluid, and equipped with spray lances. | Local supply |
| Ground servicing stands, to enable an operator to direct the spray down onto the aerofoil surfaces. | Local supply |

**B. Fluids required:**

**WARNING: GROUND DE-ICING FLUIDS, IN PARTICULAR AEA/SAE/ISO TYPE 1 FLUIDS, HAVE LIMITED PERIODS OF EFFECTIVENESS (REFERRED TO AS 'HOLDOVER' TIMES). FOR AEA/SAE/ISO TYPE II FLUIDS OBSERVE THE GUIDELINES AND CAUTIONS LAID OUT IN *TABLE 301*. FOR AEA/SAE/ISO TYPE I FLUIDS OBSERVE THE GUIDELINES AND CAUTIONS LAID OUT IN *TABLE 302*. THE USE OF AEA/SAE/ISO TYPE I FLUIDS SHOULD ONLY BE CONSIDERED WHERE AEA/SAE/ISO TYPE II FLUIDS ARE NOT AVAILABLE.**

**CAUTION: ALTHOUGH THE FOLLOWING FLUIDS PASS THE DTD CRAZING TEST FOR TRANSPARENT PANELS, DO NOT APPLY HOT SPRAY DIRECTLY ONTO WINDOW PANELS OR SEALS AS DAMAGE MAY OCCUR.**

(1) The following ground de-icing fluids are approved for the structure:

AEA/SAE/ISO Type I fluids:

- DTD 900/4907 (Kilfrost).

AEA/SAE/ISO Type II fluids:

- Kilfrost ABC-3 de-icing fluid
- Hoechst 1704/LTV88
- SPCA AD104.
- UCAR ULTRA

(2) The following fluid is approved for the windscreen and other transparent panels:

- Kilfrost WWF MOD 2 windscreen wash fluid (DTD 900/4939).

### C. Guidelines to holdover times

(1) The following general information is derived from a review of data issued by the UK CAA in CAP512 (December 1985) and the FAA in AC 120-58 (30th September 1992).

(2) The use of the fluids listed in *Table 301* is strongly recommended whenever possible, however, where the above fluids are not available, the AEA/SAE/ISO Type I ground de-icing fluids may be used provided that the WARNING concerning the limited holdover times given by AEA/SAE/ISO Type I fluids for residual protection is complied with.

(3) Before take-off the pilot in command must be satisfied the airplane is clear of frost, snow or ice, within the limitations stated in the Aircraft Flight Manual.

(4) If the holdover time is exceeded and visual/tactile investigation of flight surfaces is not possible, then the airplane should be returned for further treatment with de-icing fluid before takeoff.

(5) Freezing point of AEA/SAE/ISO Type I fluid mixture used must be at least 10°C (18°F) below OAT.

**CAUTION: *TABLE 301* IS FOR USE IN DEPARTURE PLANNING ONLY AND IT SHOULD BE USED IN CONJUNCTION WITH PRE TAKE-OFF CHECK PROCEDURES.**

**CAUTION: THE DATA CONTAINED IN *TABLE 301* IS NOT SPECIFIC TO ANY AIRPLANE CONFIGURATION. UNDER NO CIRCUMSTANCES IS THE DATA TO BE USED FOR ANY PURPOSE OTHER THAN GENERAL GUIDANCE.**

**CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN SEVERE WEATHER CONDITIONS. HIGH WIND VELOCITY AND JET BLAST MAY CAUSE A DEGRADATION OF THE PROTECTIVE FILM. IF THESE CONDITIONS OCCUR, THE TIME OF PROTECTION MAY BE SHORTENED CONSIDERABLY. THIS IS ALSO THE CASE WHEN THE FUEL TEMPERATURE IS SIGNIFICANTLY LOWER THAN THE OAT.**

*NOTE: Table 301 applies only to AEA/SAE/ISO Type II FPD fluids and no others.*

*NOTE: The responsibility for the application of this data remains with the user.*

General Guidelines For Holdover Times Anticipated by AEA/SAE/ISO Type II Fluid Mixtures as a Function of Weather Conditions and Outside Air Temperature (OAT).

*Table 301*

| OAT | | AEA/SAE/ISO Type II Fluid Concentration Neat-Fluid/Water [% by Volume] | Approximate Holdover Times Anticipated Under Various Weather Conditions (Hours: Minutes) | | | | |
|---|---|---|---|---|---|---|---|
| °C | °F | | FROST | FREEZING FOG | SNOW | FREEZING RAIN | RAIN ON COLD SOAKED WING |
| 0 and above | 32 and above | 100/0 | 8:00 | 1:15-3:00 | 0:25-1:00 | 0:08-0:20 | |
| | | 75/25 | 5:00 | 0:50-2:00 | 0:20-0:45 | 0:04-0:10 | |
| | | 50/50 | 3:00 | 0:35-1:30 | 0:15-0:30 | 0:02-0:05 | |
| below 0 to -7 | below 32 to 19 | 100/0 | 8:00 | 0:35-1:30 | 0:20-0:45 | 0:08-0:20 | **CAUTION:** CLEAR ICE MAY REQUIRE TOUCH FOR CONFIRMATION |
| | | 75/25 | 5:00 | 0:25-1:00 | 0:15-0:30 | 0:04-0:10 | |
| | | 50/50 | 3:00 | 0:20-0:45 | 0:05-0:15 | 0:01-0:03 | |
| below -7 to -14 | below 19 to 7 | 100/0 | 8:00 | 0:35-1:30 | 0:20-0:45 | | |
| | | 75/25 | 5:00 | 0:25-1:00 | 0:15-0:30 | | |
| below -14 to -25 | below 7 to -13 | 100/0 | 8:00 | 0:35-1:30 | 0:20-0:45 | | |
| below -25 | below -13 | 100/0 if 7°C (13°F) buffer is maintained | A buffer of at least 7°C(13°F) must be maintained for AEA/SAE/ISO Type II used for anti-icing at OAT below -25°C (-13°F). Consider use of AEA/SAE/ISO Type I fluids **only** where AEA/SAE/ISO Type II are not available. | | | | |

**CAUTION: *TABLE 302* IS FOR USE IN DEPARTURE PLANNING ONLY AND IT SHOULD BE USED IN CONJUNCTION WITH PRE TAKE-OFF CHECK PROCEDURES.**

**CAUTION: THE DATA CONTAINED IN *TABLE 302* IS NOT SPECIFIC TO ANY AIRPLANE CONFIGURATION. UNDER NO CIRCUMSTANCES IS THE DATA TO BE USED FOR ANY PURPOSE OTHER THAN GENERAL GUIDANCE.**

**CAUTION: THE TIME OF PROTECTION WILL BE SHORTENED IN SEVERE WEATHER CONDITIONS. HIGH WIND VELOCITY AND JET BLAST MAY CAUSE A DEGRADATION OF THE PROTECTIVE FILM. IF THESE CONDITIONS OCCUR, THE TIME OF PROTECTION MAY BE SHORTENED CONSIDERABLY. THIS IS ALSO THE CASE WHEN THE FUEL TEMPERATURE IS SIGNIFICANTLY LOWER THAN THE OAT.**

*NOTE: Table 302 applies only to AEA/SAE/ISO Type I FPD fluids and no others.*

*NOTE: The responsibility for the application of this data remains with the user.*

*NOTE: No significant increase in holdover time is achieved by strengthening the mix of AEA/SAE/ISO Type I fluids.*

General Guidelines For Holdover Times Anticipated by AEA/SAE/ISO Type I Fluid Mixtures as a Function of Weather Conditions and (OAT)

*Table 302*

| OAT | | Approximate Holdover Times Anticipated Under Various Weather Conditions (Hours: Minutes) | | | | |
|---|---|---|---|---|---|---|
| xC | xF | FROST | FREEZING FOG | SNOW | FREEZING RAIN | RAIN ON COLD SOAKED WING |
| 0 and above | 32 and above | 0:18-0:45 | 0:12-0:30 | 0:06-0:15 | 0:02-0:05 | 0:06-0:15 |
| below 0 to -7 | below 32 to 19 | 0:18-0:30 | 0:06-0:15 | 0:06-0:15 | 0:01-0:03 | CAUTION: CLEAR ICE MAY REQUIRE TOUCH FOR CONFIRMATION |
| below -7 | below 19 | 0:12-0:30 | 0:06-0:15 | 0:06-0;15 | | |

D. **General application**

**WARNING: MAKE SURE THE AIRPLANE IS GROUNDED BEFORE COMMENCING ANY WORK.**

**WARNING: WHILE PERFORMING THESE PROCEDURES, THE SURFACES WILL BE VERY SLIPPERY DUE TO SNOW, ICE, OR DE-ICING FLUID; USE A SERVICING STAND WHENEVER POSSIBLE. FAILING THIS, USE MAINPLANE MATS, SAFETY BELTS, AND TAKE OTHER SIMILAR PRECAUTIONS. ALWAYS STAND UPWIND OF THE AIRPLANE.**

**WARNING: DE-ICING FLUIDS ARE TOXIC. AVOID CONTACT WITH SKIN AND EYES, USE GOGGLES AND PROTECTIVE CLOTHING.**

**CAUTION: THE DE-ICING FLUID USED MUST BE TO A CONCENTRATION AND AT A TEMPERATURE IN ACCORDANCE WITH THE FLUID MANUFACTURER'S INSTRUCTIONS, PROVIDED THE FOLLOWING LIMITATIONS ARE NOT EXCEEDED:**

- **THE TEMPERATURE OF THE FLUID APPLIED TO THE AIRCRAFT MUST NOT EXCEED 80°C (176°F), AND IF THE SPRAY RATE PER LANCE EXCEEDS 10 IMP. GAL/MIN. (12 US GAL/MIN OR 45 LITRES/MIN), REDUCE THE TEMPERATURE TO 60°C (140°F).**
- **BEFORE APPLYING FLUID, GROUND THE AIRPLANE AND MAKE SURE THAT COVERS AND BLANKS ARE INSTALLED TO THE FOLLOWING:**
  **- STATIC VENTS.**

**- PITOT HEADS.**
**- STALL DETECTOR VANES.**

- **TO PREVENT POSSIBLE INGESTION OF DE-ICING FLUID, DO NOT OPERATE APU WHILE DE-ICING IS IN PROGRESS.**
- **AFTER CLEARING SNOW FROM THE SURFACES, MAKE SURE THE FOLLOWING ARE FREE FROM SNOW OR ICE:**
  **- ALL AIR INTAKES.**
  **- CONTROL SURFACE HINGES.**
  **- GAPS BETWEEN WING TRAILING EDGE SHROUD AND FLAPS, AIRBRAKES AND AILERONS.**
  **- GAPS BETWEEN HORIZONTAL STABILIZER AND ELEVATORS.**
  **- GAPS BETWEEN RUDDER AND VERTICAL STABILIZER.**
  **- WHEEL BRAKES.**
  **- LANDING GEAR BAYS.**
  **- ALL DOORS AND EXTERNAL DRAINS.**

**CAUTION: THE DIRECTIONS GIVEN IN THE FLUID MANUFACTURER'S INSTRUCTIONS REGARDING THE POSSIBILITY OF MIXING UCAR ULTRA WITH THE RESIDUES OF OTHER FLUIDS MUST BE STRICTLY ADHERED TO. MINOR CONTAMINATION WITH TYPE 1 FLUIDS CAN SIGNIFICANTLY DEGRADE THE ANTI-ICING PERFORMANCE.**

**E. Remove hoar frost**

(1) Spray with de-icing fluid to fluid manufacturers instructions.

(2) Under severe frost forming conditions, after defrosting, give a further light application of the concentrated fluid to make sure of the maximum holdover period.

**F. Remove sleet and freezing rain**

**CAUTION: AFTER SPRAYING, EXAMINE SURFACE THOROUGHLY, AS ICE FORMED BY FREEZING RAIN CAN BE DIFFICULT TO SEE UNDER THE DE-ICING FLUID.**

(1) Spray with undiluted de-icing fluid.

**G. Remove snow**

(1) Dry snow:

(a) Remove by brushing, or by the application of a cold air blast, taking care not to trap the snow in the control surface gaps and hinges.

(b) If the ambient temperature is above freezing, the snow can be removed by the application of a hot air blast, and the cleared surface sprayed with diluted de-icing fluid.

(2) Wet snow:

(a) Remove with rubber squeegees, taking care not to trap the snow in the control surface gaps and hinges.

(b) If ice has formed under the snow, clear by spraying with de-icing fluid.

(3) Frozen snow and ice films:

(a) Clear off any loose snow, then apply a heavy spray of de-icing fluid to the manufacturers instructions.

- Brush the snow as the fluid is being applied; this will assist in breaking up the deposit and help to retain the fluid on the deposit. When all frozen deposits have been removed, give a final light spray.

(b) If the ambient temperature is above 0°C (32°F), ducted hot air blasts may be used to disperse the ice.

- Do not use hot air blasts near windows, and take extreme care to prevent damage by overheating to painted surfaces, rubber, glass, acrylic or glass fibre, hydraulic pipelines, grease or oiled surfaces.
- Brush off or mop up water resulting from melted ice, as soon as possible.

**H. De-icing windshield**

(1) Lightly spray windshield with Kilfrost de-icing fluid WWF MOD2. If smearing occurs, wipe clear using a warm damp rag.

**I. De-icing landing gear**

**CAUTION: DE-ICING FLUID MUST NOT COME INTO CONTACT WITH LANDING GEAR ELECTRICAL PLUGS AND HARNESSES.**

**CAUTION: DO NOT LET DE-ICING FLUID CONTACT BRAKE UNITS.**

(1) Brush-off loose accumulations of snow with soft brush.

(2) Remove stubborn deposits with a rag soaked in de-icing fluid.

**J. Anti-icing**

(1) If meteorological reports predict the onset of freezing rain or heavy hoar frost deposits, an anti-icing spray of cold (or hot if cold not available) concentrated Kilfrost ABC-3, Hoechst 1704/ LTV88, SPCA AD104 or UCAR ULTRA will give limited holdover protection times, guidance for which is in *Table 301*. If the precipitation is extremely heavy, deposits will form on top of the coating, but these will have little, if any, adhesion to the surfaces and can be easily removed with light spray of hot diluted fluid.

**K. Remove salt or chemical agents**

**CAUTION: DO NOT USE HIGH PRESSURE WATER; DAMAGE MAY RESULT TO ELECTRICAL EQUIPMENT AND LUBRICATED COMPONENTS.**

(1) Where contamination has occurred on the structure, due to the aircraft landing on airfields where the snow or ice has been dispersed with salt or chemical melting agents:

(a) Wash down the affected areas with clean water as soon as possible. A wetting agent, such as Teepol or Comprex A, may be added in small quantities.

(b) When the time or conditions prevent removal of the contamination at outstations, this must be noted in the technical log, so that appropriate action may be taken to remove it at main base.

# LANDING GEAR - SERVICING

## 1. Tires

### A. Check and adjust tire pressures *(Table 301 )*

**CAUTION: ONLY NITROGEN IS TO BE USED FOR TIRE INFLATION.**

**CAUTION: WHEN CHARGING THE TIRE, ADMIT NITROGEN SLOWLY TO PREVENT EXCESS TEMPERATURE AND FALSE READINGS.**

| Equipment/Materials | Part/Item No. |
|---|---|
| Tire inflation gauge, 0-200 psi | Local supply |
| Tire inflation trolley | Local supply |

*NOTE: In some circumstances, for example when operating from unpaved surfaces, it may be desirable to reduce tire pressures below those given in Table 301. For information on permissible tire pressure deviations refer to the Crew Manual.*

(1) The use of high pressure nitrogen bottles is recommended, but it is essential that a suitable pressure reducing valve is incorporated in the delivery line. Inflate the tires to the required pressures.

*NOTE: Pressure loss at ambient temperature must not exceed 5% of the inflation pressure during any 24 hour period. After landing, there will be a rise in main wheel tire pressure due to brake heat. Allowance must be made for this pressure rise when checking tire pressures if the duration of the stop does not permit waiting for the gas in the tire to cool.*

(2) With airplane standing on its wheels, check tire pressures with an inflation gauge (pressure range 0-200 psi) and a screw on inflation connector.

(3) The weight-on-wheels pressures given in *Table 301* below may be used, up to maximum takeoff weight, for general operation from normal runway surfaces.

Tire pressures (weight-on-wheels)

*Table 301*

| Airplane Series | tire pressures (psi) Main wheels (+6 -0 psi) | tire pressures (psi) Nose wheels (+6 -0 psi) |
|---|---|---|
| 400A, 400B | 118 | 80 |
| 401B/403B, 3B/RC, 400A with Mod.252550, F400B | 120 | 80 |

## 2. Leg assemblies *(Figure 301, Figure 302, Figure 303)*

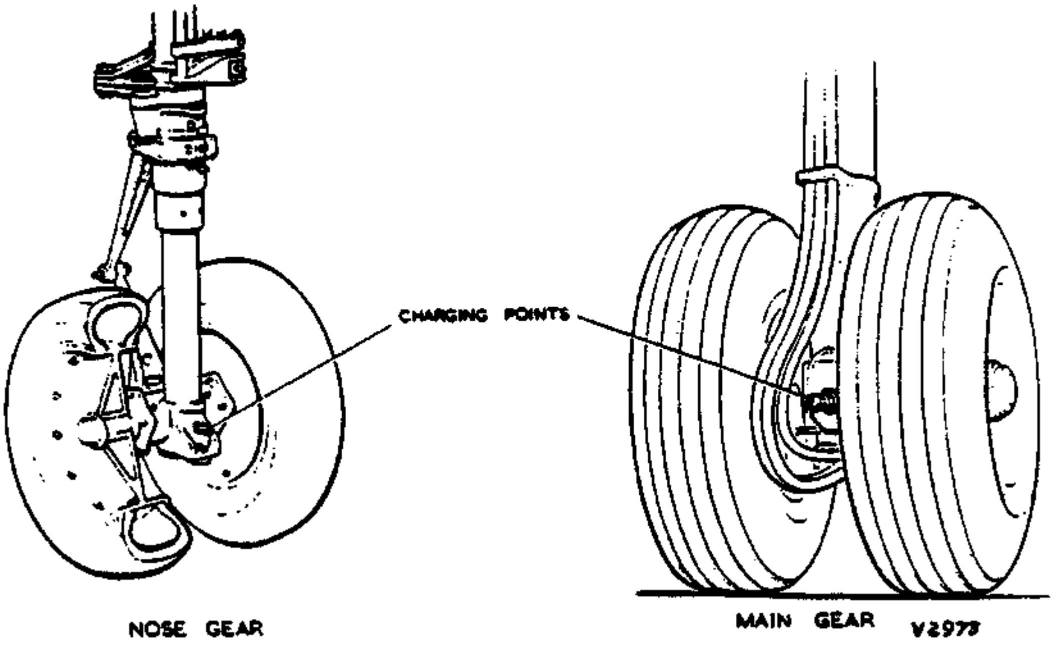
### A. Check nitrogen inflation pressures

**CAUTION: ONLY NITROGEN IS TO BE USED FOR LEG INFLATION.**

*NOTE: The use of high pressure nitrogen bottles is recommended, but it is essential that a suitable pressure reducing valve is incorporated in the delivery line.*

| Equipment/Material | Part/Item No. |
|---|---|
| Turner inflation adapter | Turner 772 or suitable alternative |
| Gauge (0-600 psi) | Turner F29/24/600 or suitable alternative |
| Gauge (0-1500 psi) | Turner F29/24/1500 or suitable alternative |

*NOTE: The inflation diagrams are based on the assumption that the oil level is correct. When the oil level is correct, the leg can be inflated to the pressure to correspond with the extension. The leg extension must NOT be adjusted, by altering the nitrogen pressure, if any doubt exists about the oil level.*



Leg charging valves
*Figure 301*

(1) Examine for signs of oil leakage.

(2) Remove charging valve cap and connect charging adapter with gauge.

(3) Check that the extension of the leg is correct for the pressure reading obtained on the pressure indicator.

NOTE: *Should the leg extension be incorrect, check oil level (Chapter 32, MAIN OR NOSE LEG ASSEMBLY, as appropriate).*

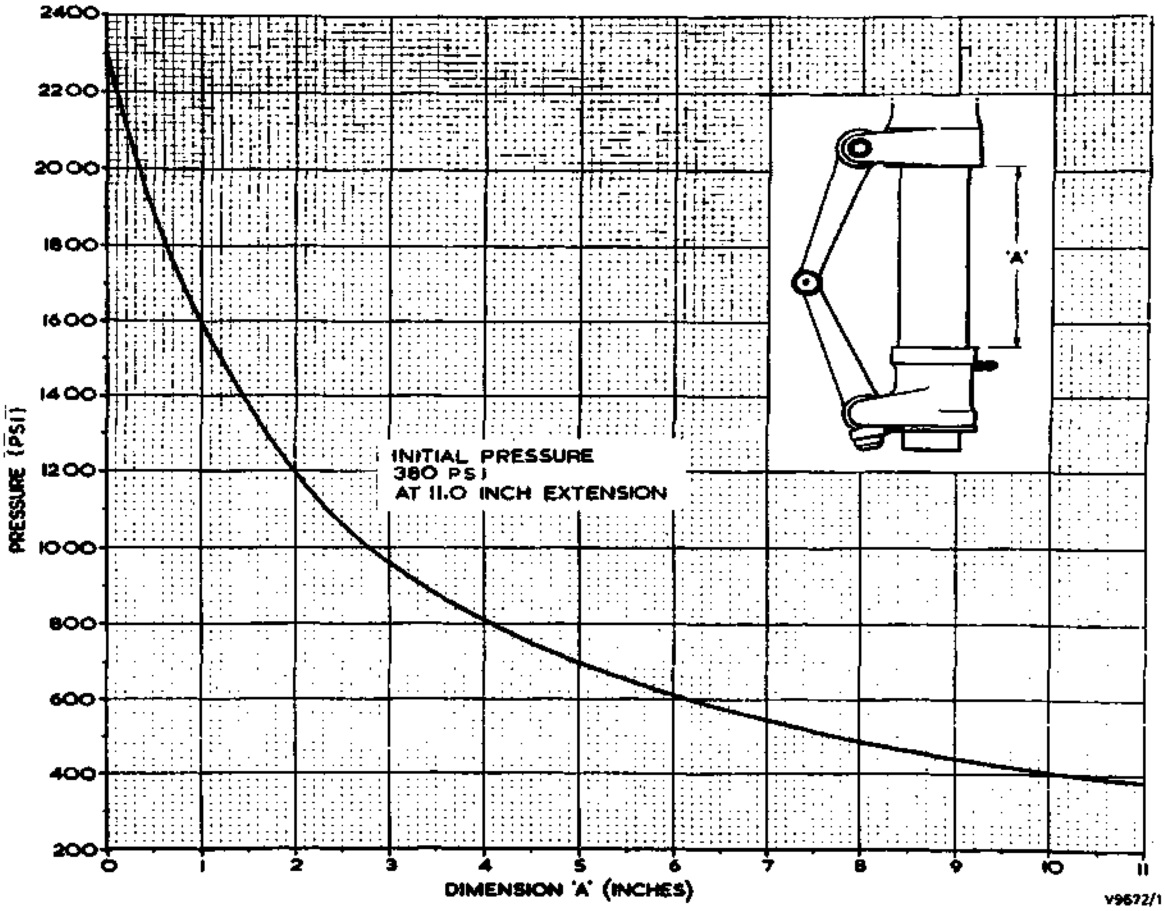
**CAUTION: WHEN CHARGING THE LEG, ADMIT NITROGEN SLOWLY TO PREVENT EXCESS TEMPERATURE AND FALSE READINGS.**

(4) Inflate as necessary with nitrogen until pressure/extension is within limits given.

(5) Shut off charging supply.

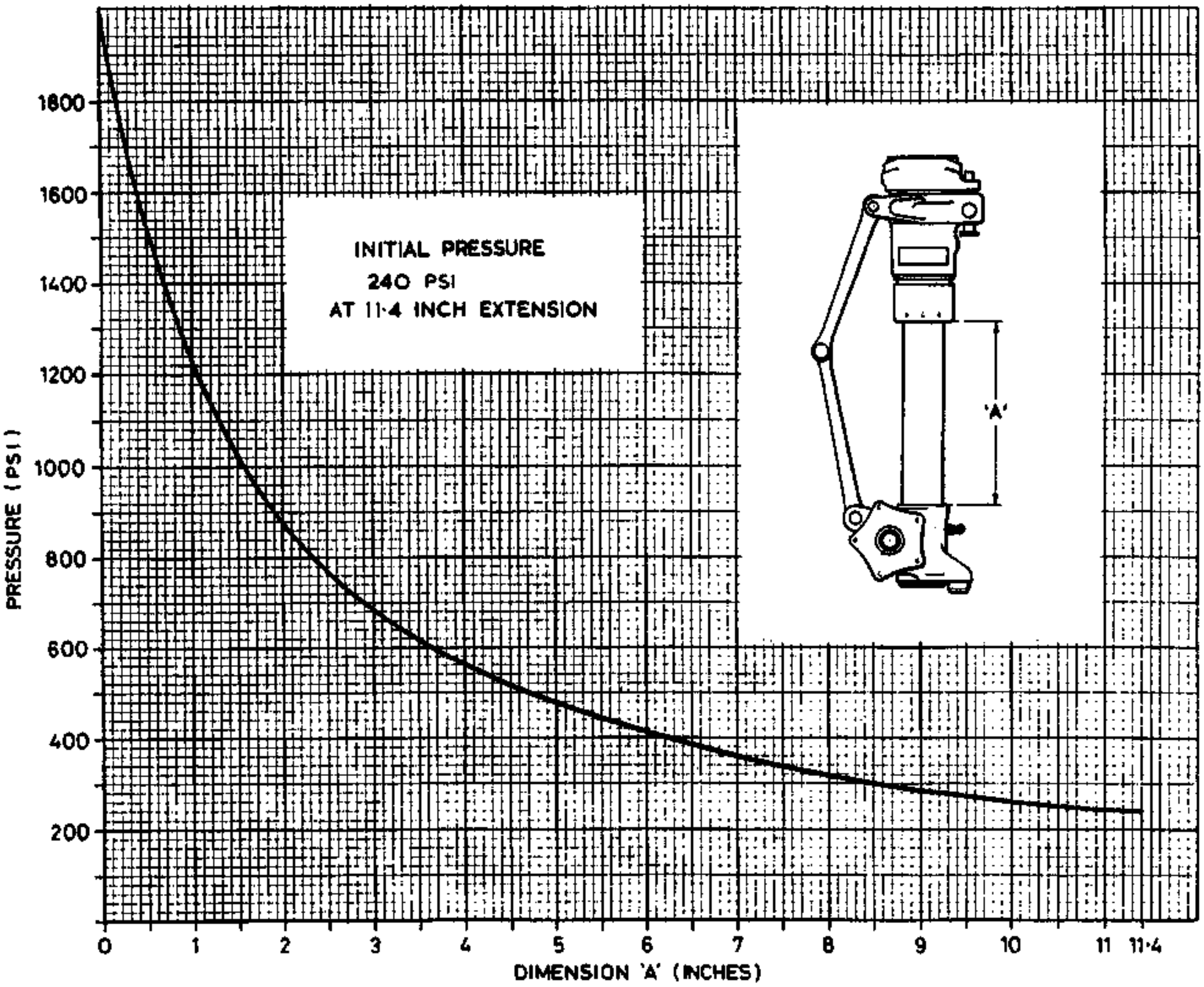
(6) Disconnect charging equipment, and check for leaks.

(7) Install charging valve cap.



Main gear-pressure/extension graph

*Figure 302*



M 1800

Nose gear-pressure/extension graph

*Figure 303*

# OXYGEN (Mod.251630) - SERVICING

**WARNING:** OXYGEN FORMS AN EXPLOSIVE MIXTURE WITH OIL, GREASE, FUEL OR METAL DUST. USE DEGREASED TOOLS AND CLEAN HANDS.

**WARNING:** MAKE SURE THAT NO ELECTRICAL OR MOTOR DRIVEN GROUND EQUIPMENT IS CONNECTED TO THE AIRCRAFT.

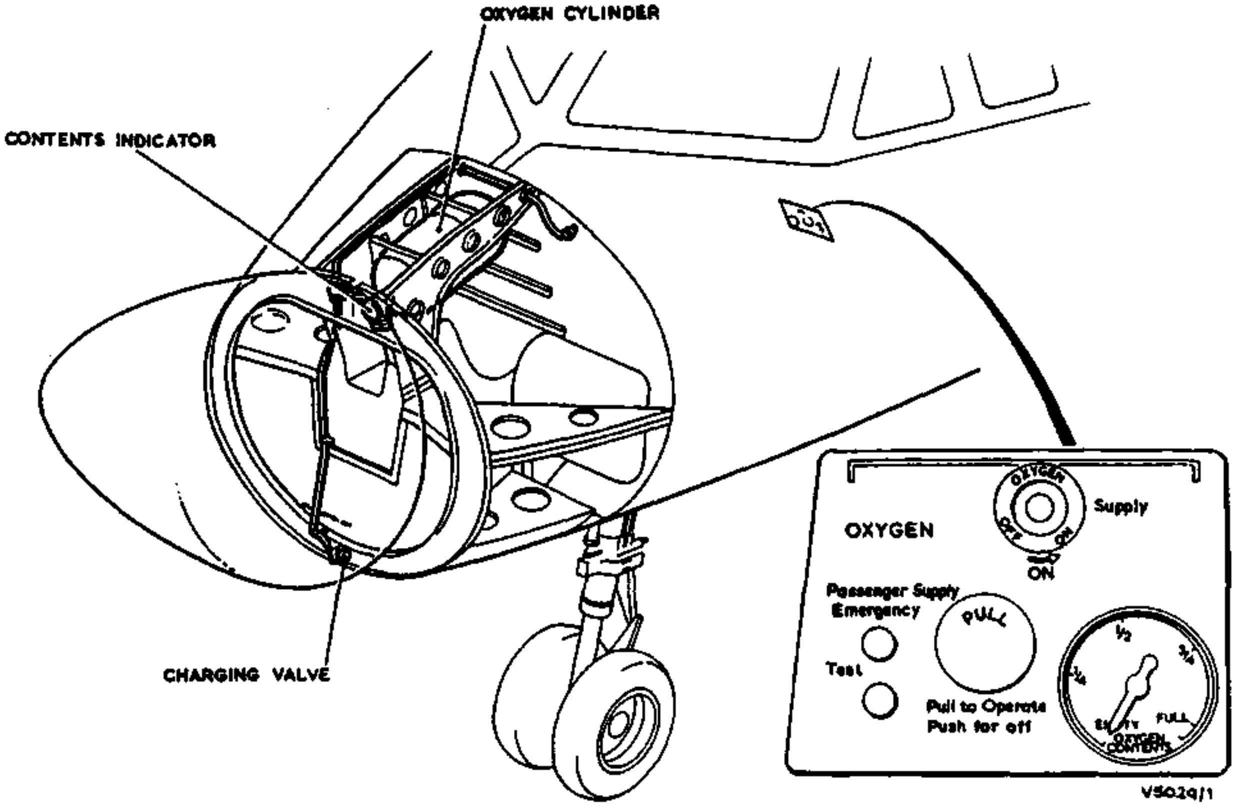
**WARNING:** MAKE SURE THAT A CARBON DIOXIDE FIRE EXTINGUISHER IS IMMEDIATELY AVAILABLE.

**WARNING:** THE MASTER SUPPLY VALVE MUST BE FULLY OPEN OR CLOSED FINGER TIGHT ONLY. DO NOT TRY TO STOP A LEAK BY OVER-TIGHTENING.

**WARNING:** DO NOT OPEN VALVES RAPIDLY OR INCREASE PRESSURE RAPIDLY.

**WARNING:** ONLY OXYGEN THAT CONFORMS TO THE CORRECT SPECIFICATION MUST BE USED TO FILL THE SYSTEM (REFER TO THE EQUIPMENT/MATERIALS LISTING). DO NOT USE INDUSTRIAL OR WELDING OXYGEN.

**WARNING:** BEFORE BONDING THE OXYGEN CHARGING RIG TO THE AIRCRAFT, MAKE SURE THAT BOTH THE RIG AND THE AIRCRAFT ARE INDIVIDUALLY BONDED TO GROUND (EARTH).



Oxygen servicing point
*Figure 301*

## 1. System servicing

### A. Check system contents

(1) Open the master SUPPLY valve and note contents on adjacent contents indicator.

(2) Close the master SUPPLY valve.

### B. Replenish system

| Equipment/Materials | Part/Item No. |
|---|---|
| Oxygen charging rig | Oxygen conforming to:<br>• BS 2N3 1990<br>• ISO 2046<br>• DEF.STAN.68-21<br>• MIL-O-27210 |

(1) Unclip and raise weather radar radome and secure in raised position.

(2) Connect oxygen charging rig to the aircraft charging valve as follows:

  (a) Make sure that the aircraft is bonded to ground (earth).

  (b) On oxygen charging rig, connect bonding cable to ground (earth).

  (c) Connect the other bonding cable on oxygen charging rig to a convenient bonding stud on the aircraft.

  (d) Remove charging valve cap and connect hose from oxygen charging rig.

(3) Open the rig delivery valve slowly and charge the system to approximately 1900 psi. Shut off rig delivery valve and allow system to cool. When cool, top up if necessary to 1800 psig (at 21°C) and check that the cylinder contents indicator shows FULL.

(4) Check system contents on flight compartment gauge.

(5) Remove oxygen charging rig from aircraft as follows:

  (a) Remove hose from oxygen charging rig and install charging valve cap.

  (b) Remove bonding cable from oxygen charging rig to bonding stud on aircraft.

  (c) Remove bonding cable from ground to oxygen charging rig.

  (d) Remove main aircraft bonding.

(6) Close and secure weather radar radome.

# OXYGEN (Mod.252036 - bottles in rear fuselage)
# SERVICING

**WARNING: OXYGEN FORMS AN EXPLOSIVE MIXTURE WITH OIL, GREASE, FUEL OR METAL DUST. USE DEGREASED TOOLS AND CLEAN HANDS.**

**WARNING: MAKE SURE THAT NO ELECTRICAL OR MOTOR DRIVEN GROUND EQUIPMENT IS CONNECTED TO THE AIRCRAFT.**

**WARNING: MAKE SURE THAT A CARBON DIOXIDE FIRE EXTINGUISHER IS IMMEDIATELY AVAILABLE.**

**WARNING: THE MASTER SUPPLY VALVE MUST BE FULLY OPEN OR CLOSED FINGER TIGHT ONLY. DO NOT TRY TO STOP A LEAK BY OVER-TIGHTENING.**

**WARNING: DO NOT OPEN VALVES RAPIDLY OR INCREASE PRESSURE RAPIDLY.**

**WARNING: ONLY OXYGEN THAT CONFORMS TO THE CORRECT SPECIFICATION MUST BE USED TO FILL THE SYSTEM (REFER TO THE EQUIPMENT/MATERIALS LISTING). DO NOT USE INDUSTRIAL OR WELDING OXYGEN.**

**WARNING: BEFORE BONDING THE OXYGEN CHARGING RIG TO THE AIRCRAFT, MAKE SURE THAT BOTH THE RIG AND THE AIRCRAFT ARE INDIVIDUALLY BONDED TO GROUND (EARTH).**

## 1. System servicing

### A. Check system contents

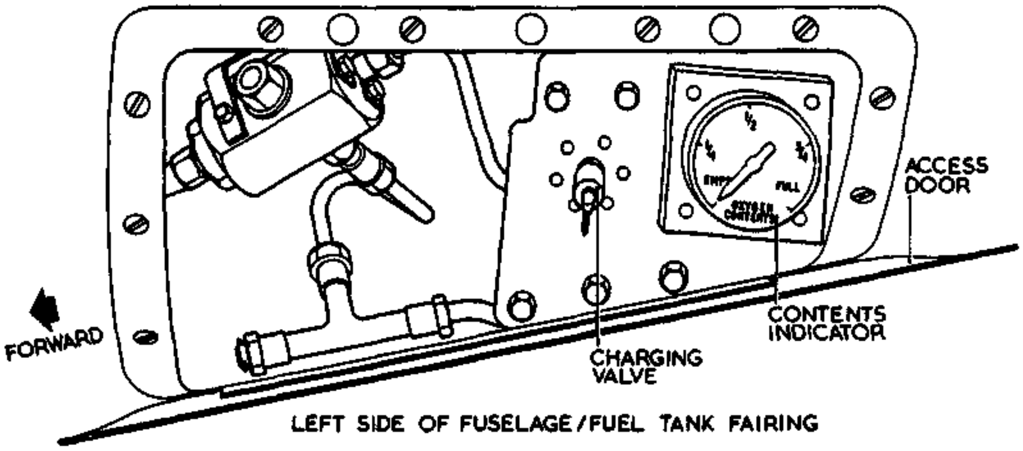
(1) Gain access to the oxygen charging point.

(2) Open master SUPPLY valve on oxygen panel and note contents on adjacent contents indicator.

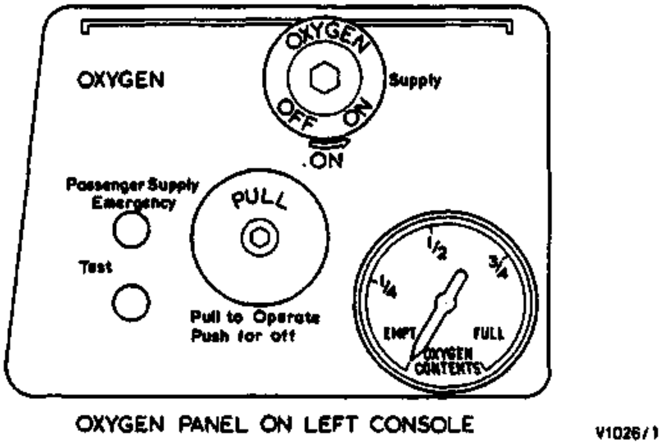
(3) Close master SUPPLY valve and access door.

### B. Replenish system

| Equipment/Materials | Part/Item No. |
|---|---|
| Oxygen charging rig | Oxygen conforming to:<br>• BS 2N3 1990<br>• ISO 2046<br>• DEF.STAN.68-21<br>• MIL-0-27210 |



**Oxygen charging point**



**Flight compartment oxygen services panel**

*Figure 301*

(1) Open charging point access door.

(2) Connect the oxygen charging rig to the aircraft charging valve as follows:

  (a) Make sure that the aircraft is bonded to ground (earth).

  (b) On the oxygen charging rig, connect the bonding cable to ground (earth).

  (c) Connect the other bonding cable on the oxygen charging rig to a convenient bonding stud on the aircraft.

  (d) Remove the charging valve cap and connect the hose from the oxygen charging rig.

(3) Open the rig delivery valve and set the regulator valve to charge the system slowly to approximately 1900 psi. Close the delivery valve and let the system cool. Check the system contents on the adjacent contents indicator and top up if necessary until the indicator shows FULL, when the system pressure will be 1800 psig (at 21°C).

(4) Check system contents on the contents indicator in the flight compartment. If the reading is less than that shown on the servicing point contents indicator, reset the automatic shut-off valve as follows:

  (a) Open rear equipment bay access door and gain access to the oxygen cylinders.

  (b) Slacken hose clips on screen tubes and remove sealing ring halves.

  (c) Move, in turn, each screen tube aside to gain access to the cylinder stop valve. Close stop valve on each cylinder.

  (d) Slowly release pressure by partially unscrewing the plug at T-piece and let pressure shown on charging point indicator decrease until both indicators show the same pressure. Tighten the plug and safety with lockwire.

  (e) At each cylinder, safety the stop valve in the open position with lockwire. Replenish the system. Make sure both indicators show the same pressure.

  (f) Position screen tubes and sealing ring halves. Tighten hose clips.

  (g) Close the rear equipment bay access door.

(5) Remove the oxygen charging rig from the aircraft as follows:

  (a) Remove the hose from the oxygen charging rig and install the charging valve cap.

  (b) Remove the bonding cable from the oxygen charging rig to the bonding stud on the aircraft.

  (c) Remove the bonding cable from ground to the oxygen charging rig.

  (d) Remove the main aircraft bonding.

(6) Close and secure the charging point access door.

# WATER/WASTE - SERVICING

Operators are advised to incorporate the following system checks when servicing the water/waste systems. Use the applicable vendor maintenance manual together with the following system checks for the water/waste system which is installed on a particular aircraft.

## 1. Wash water system

### A. Drain the system

(1) Make sure the system has no leaks.

(2) Make sure spilled and leaked fluid is removed and has not contaminated the aileron cables and cable seals together with other control system cables and mechanisms located below the cabin floor.

### B. Fill and prime the system

(1) Make sure the system has no leaks.

(2) Make sure spilled and leaked fluid is removed and has not contaminated the aileron cables and cable seals together with other control system cables and mechanisms located below the cabin floor.

## 2. Waste

### A. Recharge toilet

(1) Make sure the system has no leaks.

(2) Make sure spilled and leaked fluid is removed and has not contaminated the aileron cables and cable seals together with other control system cables and mechanisms located below the cabin floor.

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## SERVICING

## AUXILIARY POWER UNIT

### 1. General

#### A. Oil system capacity

| | Imp. pints | U.S. pints | Litres |
|---|---|---|---|
| Sump capacity | 3.3 | 4.0 | 1.87 |
| Usable oil | 3.3 | 4.0 | 1.87 |

#### B. Oil consumption

| | Imp. pints/hr | U.S. pints/hr | Litres/hr |
|---|---|---|---|
| Max. permissible | 0.133 | 0.159 | 0.075 |

#### C. Approved oils

NOTE: Mixing of approved oils is not permissible. If a different approved oil is to be used comply with 'Change oil' detailed in Chapter 49, ENGINE GENERAL, LUBRICATION SYSTEM.

AeroShell Turbine Oil 300
AeroShell Turbine Oil 390 (Shell ICT 90)
AeroShell Turbine Oil 500/555
AeroShell Turbine Oil 750

Brayco 880 Conojet
Brayco 880 H
Brayco 899 S
BP Aero Turbine Oil 15
BP Air Turbine Oil 1048

Caltex RPM Jet Engine Oil 5
Castrol 3C
Castrol 98
Castrol 205
Castrol 325
Continental Conojet
Chevron Jet Oil No.5

Exxon or Esso Turbo Oil TJ-15
Exxon or Esso Turbo Oil 2380

Hatcol 3211

Mobil Jet 2
Monsanto Skylube 450

Signal Air Turb Synlube
Signal Astro Turbine 25

Sinclair Turbo Oil S 15
Sinclair Turbo Oil S Type 1048
Stauffer Jet 1
Stauffer Jet 2

Texaco or Caltex SATO 15
Texaco or Caltex SATO 7730

continued overleaf

...Servicing - Auxiliary Power Unit continued

## 2. Service engine oil system

### A. Check oil contents and replenish system

WARNING : SYNTHETIC OILS CAN BE TOXIC - AVOID PROLONGED CONTACT WITH THE SKIN.

NOTE : For an accurate assessment, check the oil level within 30 minutes after a.p.u. shutdown.

(1) Gain access to rear equipment bay.

(2) Remove oil sump filler cap and check level on dipstick.

(3) Ensuring scrupulous cleanliness of container add oil, as necessary, until level coincides with 'ADD' mark on dipstick.

CAUTION : OIL LEVEL MUST NOT BE ABOVE THE 'ADD' MARK.

(4) Fit and secure oil filler cap.

(5) Close rear equipment bay door, or leave open, as necessary.

(6) Record quantity of oil added to system.

* * *

## SERVICING

## WINDOWS

### 1. General

### A. Clean and polish plastic panels

CAUTION : EXTREME CARE MUST BE TAKEN WHEN CLEANING AND POLISHING TRANSPARENT PANELS, AS HARSH OR OTHERWISE UNSUITABLE AGENTS CAN CAUSE DAMAGE AND CRAZING. EFFECT ALL POLISHING BY HAND; FRICTIONAL HEAT DEVELOPED BY MECHANICAL POLISHERS INDUCES SURFACE CRAZING.

Wash transparent panels with a 1% solution of Teepol in water, applied with a soft cloth, then polish with Jove Aeropal HR/1 plastic polish. Application of Bluebell R.130 will remove surface scratches.

NOTE : Other cleaners and polishes may prove satisfactory, but care must be taken to ensure that they are suitable. Polishes must conform to DTD770. The following agents and their vapours effect crazing or dissolution of transparent plastic panels :

Acetone
Ammonia vapour
Amyl acetate
Aviation gasoline
Aviation turbine fuel
Benzine butylacetate
Bostik
Carbon tetrachloride
Cresol
Deoxidine materials
Ethylene dichloride
Glacial acetic acid
Methyl alcohol
Methylene dichloride
Nicotine
Rust remover
Synthetic finishes
Tautening dopes
Trichlorethylene cleaning agents

* * *

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# ENGINE OIL - SERVICING

## 1. General

**WARNING: SYNTHETIC OIL CAN BE TOXIC - AVOID PROLONGED CONTACT WITH THE SKIN**

**CAUTION: DO NOT ALLOW OIL TO CONTAMINATE THE AIRPLANE OR EXTERIOR OF THE ENGINE**

### A. Capacities

| Capacities | U.S. pints | Imperial pints | Liters |
|---|---|---|---|
| Total oil capacity of system | 24 | 20 | 11.4 |
| Total capacity of tank | 12 | 10 | 5.7 |
| Usable oil | 2 | 3.4 | 1.9 |

*NOTE: A card listing approved oils is located in the airplane manual stowage. The consumable quantity stated above, and on the card, refers to the oil available for use below the minimum level on the sight-glass and is sufficient for more than 12 hours engine operation at maximum oil consumption.*

### B. Consumption

| | U.S. pints | Imperial pints | Liters |
|---|---|---|---|
| Per hour | 0.4 | 0.34 | 0.19 |

*NOTE: The consumption is measured over a 15 hour period.*

### C. Approved engine oils

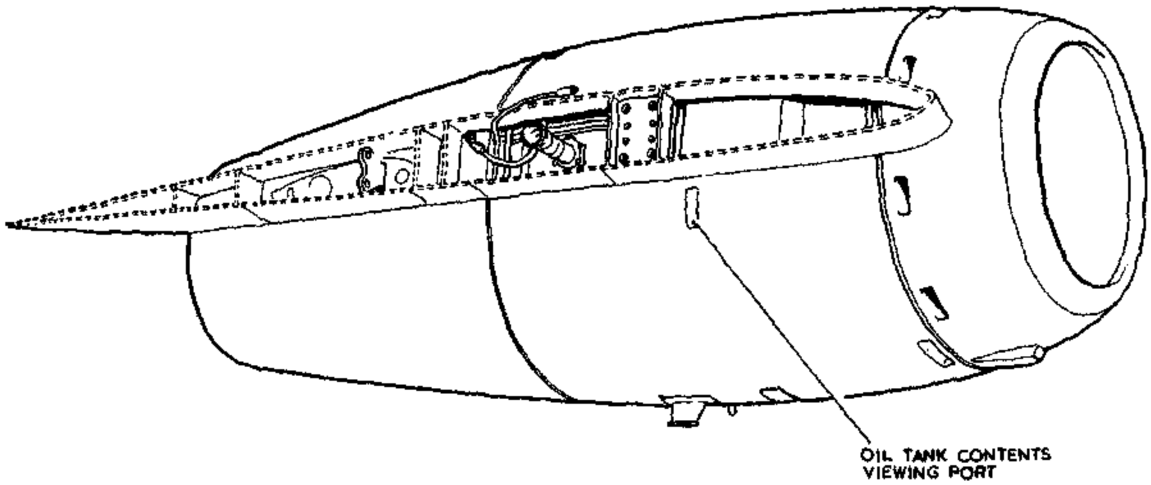
| Equipment/Material | Part/Item No. |
|---|---|
| Engine oil | 137 (Chapter 20-95-101) |

*NOTE: The listed brands of approved oil (Item 137) can be mixed. Other types of oil are not approved.*

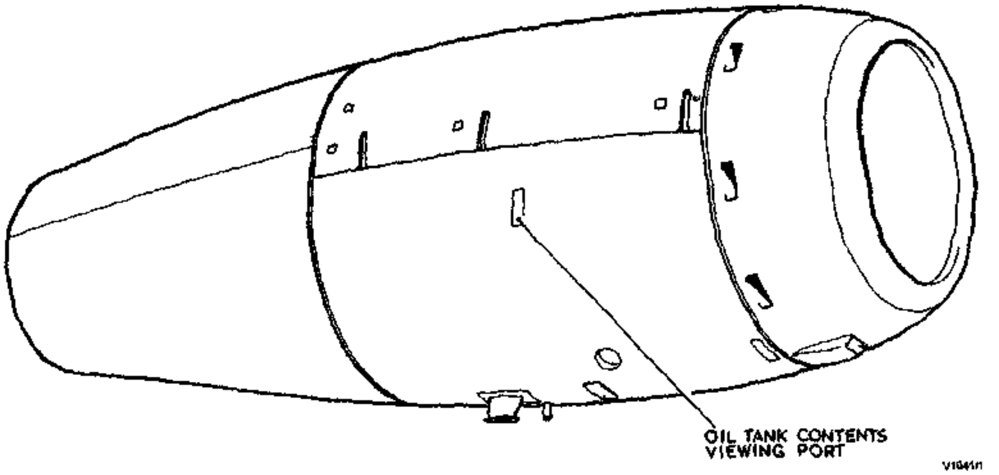
## 2. Engine oil system

### A. Check engine oil contents *(Figure 301)*

*NOTE: Check the oil level within 1 hour of engine shut down. If the oil level is not checked within this period, start the engine and run at 'idle' for 5 minutes, then check the oil level. The oil level is indicated at the bottom of the sight glass float ball.*

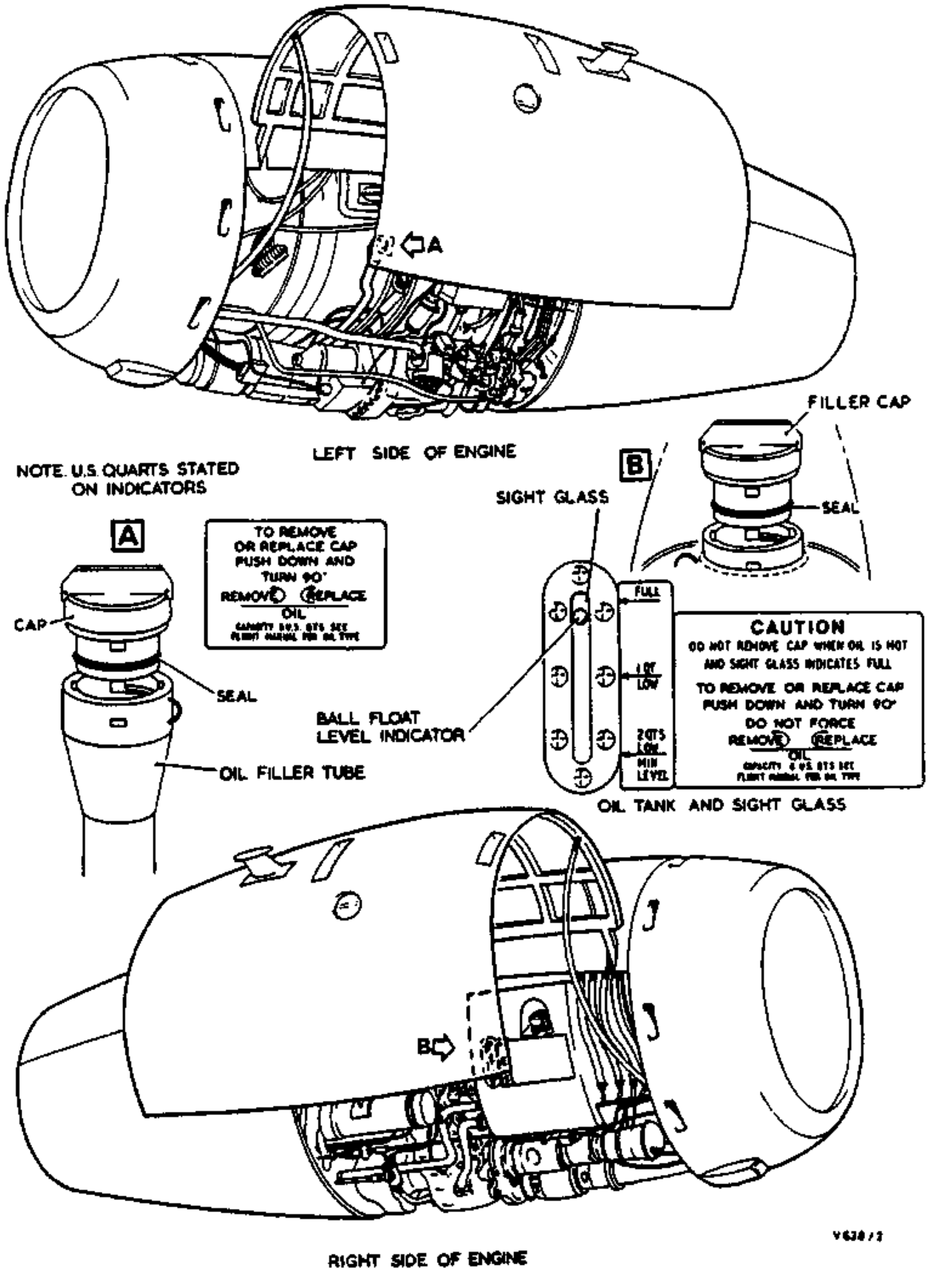


INBOARD SIDE OF LEFT-HAND POWER PLANT



OUTBOARD SIDE OF RIGHT-HAND POWER PLANT

Engine oil contents viewing ports
*Figure 301*


A
LEFT SIDE OF ENGINE
NOTE. U.S. QUARTS STATED ON INDICATORS
A
CAP
SEAL
OIL FILLER TUBE
TO REMOVE OR REPLACE CAP PUSH DOWN AND TURN 90°
REMOVE REPLACE
OIL
CAPACITY 6 U.S. QTS SEE FLIGHT MANUAL FOR OIL TYPE
B
FILLER CAP
SEAL
SIGHT GLASS
BALL FLOAT LEVEL INDICATOR
FULL
1 QT LOW
2 QTS LOW
MIN LEVEL
CAUTION
DO NOT REMOVE CAP WHEN OIL IS HOT AND SIGHT GLASS INDICATES FULL
TO REMOVE OR REPLACE CAP PUSH DOWN AND TURN 90°
DO NOT FORCE
REMOVE REPLACE
OIL
CAPACITY 6 U.S. QTS SEE FLIGHT MANUAL FOR OIL TYPE
OIL TANK AND SIGHT GLASS
B
V630/2
RIGHT SIDE OF ENGINE

Engine oil system replenishment details

*Figure 302*

(1) Check level of oil at the oil tank sight-glass, visible through the viewing port in the cowling lower access door.

(2) Record quantity of oil required.

**B. Replenish engine oil through oil tank (right-hand engine)** *(Figure 302)*

(1) Open cowling lower door to gain access to the oil tank on the right-hand side of the engine.

(2) Push oil tank filler cap down (do not force), turn 90 degrees counter-clockwise and lift from the tank.

(3) Make sure the container is clean and add oil (Item 137) to the tank until the level at the sight glass registers FULL.

(4) Inspect and renew filler cap seal if necessary.

(5) Insert filler cap into tank, push down and turn 90 degrees clockwise to secure. Do not use force.

(6) Record the quantity of oil required to fill the system.

(7) Close cowling lower access door.

**C. Replenish engine oil through filler tube (left-hand engine)** *(Figure 302)*

(1) Open cowling lower door to gain access to the oil filler tube on the left-hand side of the engine.

(2) Push filler cap down (do not use force), turn 90 degrees counter- clockwise and lift out.

(3) Make sure the container is clean and add oil (Item 137) to the filler tube until the sight glass registers FULL.

(4) Inspect and renew the filler tube cap seal, if necessary.

(5) Insert the filler cap into the filler tube, push down and turn 90 degrees clockwise to secure cap. Do not use force.

(6) Record the quantity of oil required to fill the system.

(7) Close cowling lower access door.

# CHAPTER

# 20

# STANDARD PRACTICES (AIRFRAME)

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# CHAPTER 20

# STANDARD PRACTICES - AIRFRAME

## 1. General

All information related to this chapter will be found in a stand alone manual titled Aircraft Maintenance Manual, Chapter 20, Standard Practices - Airframe, P/N AMM 125/H-20.

# CHAPTER

# 21

# AIR CONDITIONING

## Chapter 21

## AIR CONDITIONING

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* No separate description
+ No separate maintenance practices

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## AIR CONDITIONING - GENERAL

The air conditioning system maintains a supply of air for ventilation and pressurization of the flight and passenger compartments. Air delivered by the engine compressors is fed into the flight and passenger compartments at a controlled flow rate and temperature. Pressurization is effected by controlling the release of this air to ambient.

An auxiliary heating system, which derives its air supply from the No.2 engine compressors, is provided to supplement the flight compartment heating supply.

The flight compartment supply is utilized for windshield de-misting, and for the pilots' foot warmers.

* * *

## AIR SUPPLY AND DISTRIBUTION - DESCRIPTION AND OPERATION

### 1. General

Hot air from the low pressure (LP) and high pressure (HP) compressor bleeds pass through flow venturis to supply the normal system and the flight compartment auxiliary system. The purpose of the venturis is to limit the air bled from the engines to the maximum allowed by the engine manufacturer's.

Tappings are taken at the entry of each engine supply to the rear equipment bay to supply the pressurization control air jet pump, and hydraulic tank pressurization (see Chapter 29, MAIN SYSTEM).

Tappings for the rudder bias system are taken directly from the LP bleed of each engine and also from the LP duct at the LP inlet to the mixing valve (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEM).

### 2. Description (Fig.1 and 2)

### A. Normal

Air bled from the HP compressor of each engine is ducted through a flow limiting venturi, and a solenoid-operated HP air valve, mounted in the pylon fillet, to a mixing valve, one for each engine.

Air bled from the LP compressor of each engine is ducted through a flow limiting venturi directly to the mixing valve.

Each mixing valve automatically introduces HP air as required to supplement the LP air at low engine power settings, and thus maintains the air supply at the minimum required pressure. With LP air above minimum pressure, a pressure switch coupled into the rudder bias supply pipeline operates to de-energize and close the HP air valve. A temperature limiter in the mixing valve operates at 200°C to reduce the HP air bleed.

Air from each mixing valve is fed into a common supply duct through an electrically motorized main air valve and check (non-return) valve. Each main and HP air valve is controlled by a MAIN AIR VALVES - OPEN/LP ON/CLOSE switch on the PRESSURIZATION AND AIR CONDITIONING section of roof panel CG. Selecting LP ON closes the HP air valve but maintains the LP supply, and is used only if an HP duct fails. With CLOSE selected, both the main and HP air valves are closed.

Air flow through the main supply duct is controlled by a flow control valve which automatically limits the amount of air delivered to the cabin to a predetermined flow rate.

The controlled airflow may be fed to the pressurized area of the fuselage via :-

(a) the refrigeration unit by-pass valve
(b) The refrigeration unit heat exchanger and turbine by-pass valve
(c) the refrigeration unit heat exchanger and turbine
(d) a combination of (a), (b) and (c).

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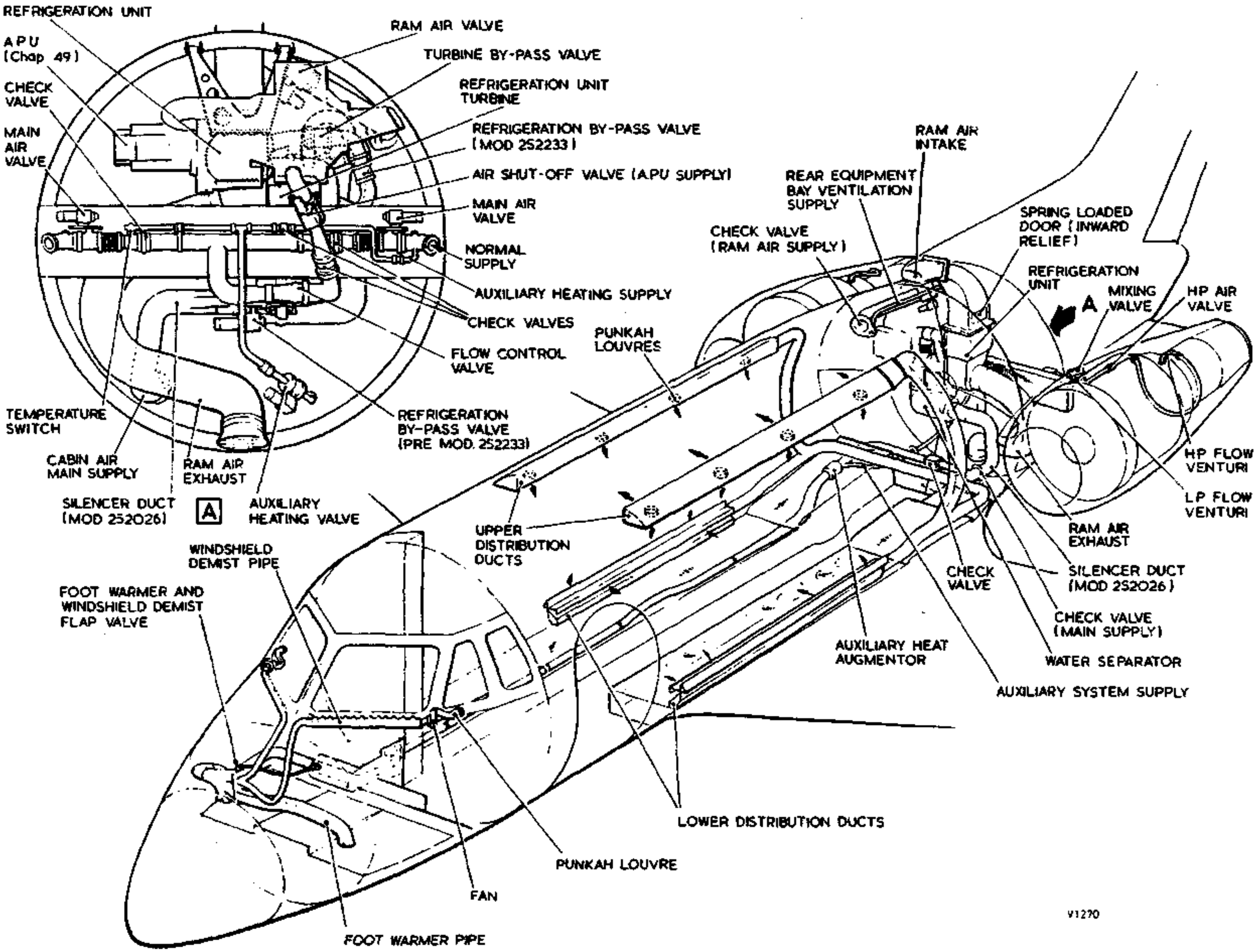
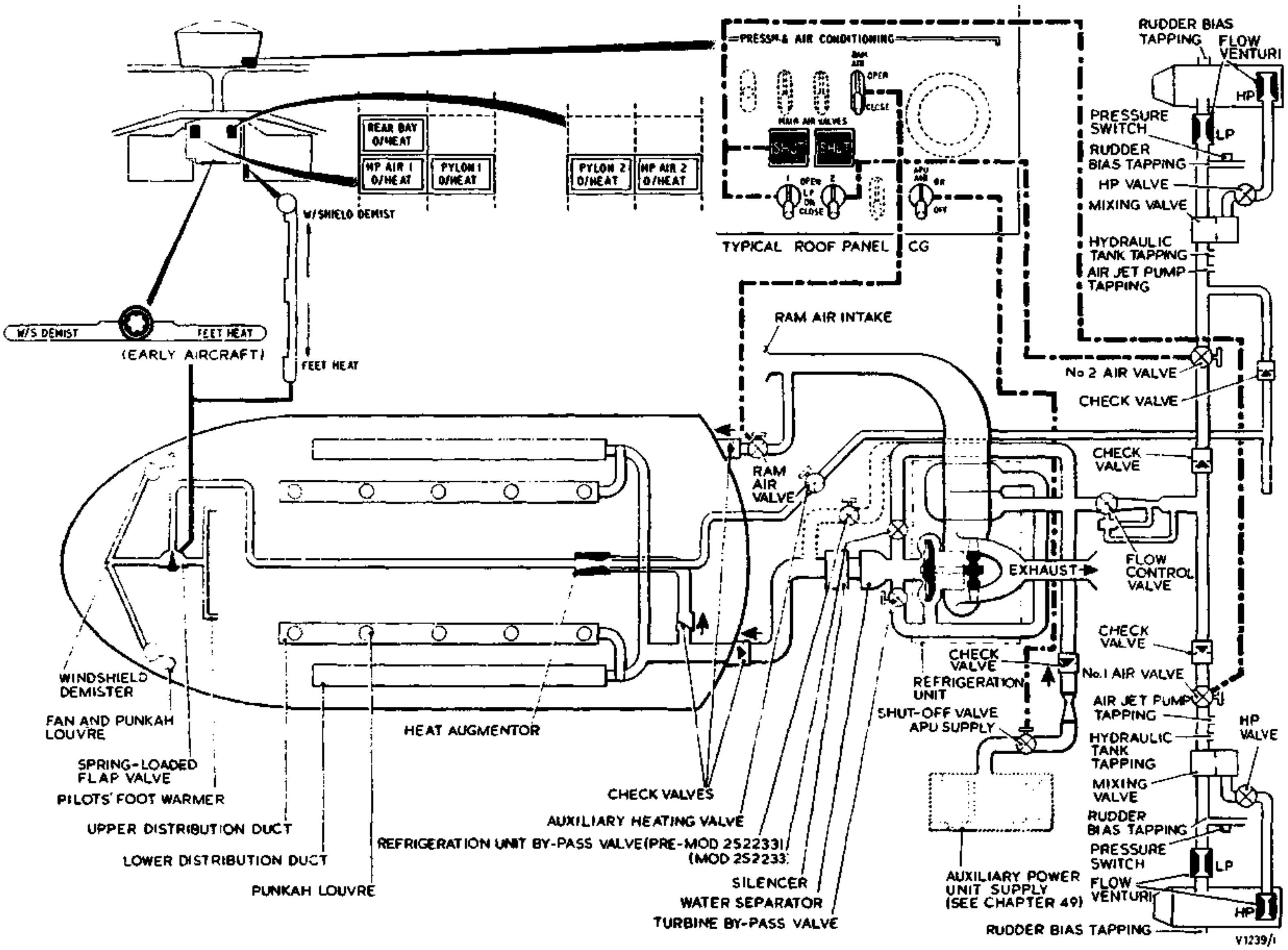


Air supply and distribution system
Fig.1



Air supply and distribution system - schematic
Fig.2

The air passing through the heat exchanger is partially cooled by ram (cooling) air flowing round the walls of the air tubes. The partially cooled air directed to a cooling turbine is further cooled prior to being discharged into the outlet duct to the system by the energy-using process of driving the tubine wheel. This cool air is used for cabin cooling purposes.

From the refrigeration unit the air is fed through a water separator where a large percentage of its moisture content is removed prior to it being fed into the main supply duct. Downstream (Pre mod.25/2233) or upstream (Mod. 25/2233) of the water separator the refrigeration unit by-pass air is tapped into the main supply duct. The airflow is then ducted through a check valve into the pressure cabin. In the pressure cabin the main supply duct feeds a supply to the flight compartment, and then bifurcates to feed a supply to both sides of the cabin.

Each cabin supply duct bifurcates to supply an upper distribution duct at roof level and a lower distribution duct at floor level. The air in the distribution ducts is fed into the cabin through the top and bottom of the ducts. Punkah louvres are fitted at intervals along the length of the upper distribution ducts; they can be manually controlled to provide air where it is required.

The cabin air exhausts through the cabin floor into the underfloor structure, and is vented to atmosphere through the pressurization outflow/safety valves situated on the rear pressure bulkhead.

The flight compartment supply is ducted below the cabin floor into the compartment where it is fed to a spring-loaded flap valve, which directs air to the pilots' footwarmers or the windshields demister according to the setting of a W/S DEMIST-FEET HEAT control knob at the bottom of the centre instrument panel or a lever in the right-hand instrument panel. The control, which is connected to the flap valve by a Bowden cable, has an intermediate selection which permits the supply of air to both the windshields and footwarmers. An electrically-driven fan is incorporated at the end of each windshield demist pipe. The fans induce air through manually controlled punkah louvres which permit control of flight compartment ventilation. The fans are operated by a CKPT FAN ON switches on the roof panel CG.

The flight compartment supply incorporates a check valve, comprising a hinged flap, and a heat augmentor which is also the inlet into the system of the auxiliary system supply. The check valve closes off the main supply duct when the flight compartment auxiliary system only is in use.

### B. Auxiliary heating system

Engine air supply to the flight compartment auxiliary system is fed from No.2 engine through a check valve to an auxiliary heating valve. From the valve the air supply is fed into the normal system through the heat augmentor. Control of the auxiliary heating valve is by a CKPT TEMP-INC/DEC switch on the roof panel CG.

...Air supply and distribution - Description and operation continued

### C. Ram air

Ram air from the dorsal air intake is used primarily as a cooling medium for the refrigeration unit heat exchanger, but it can also be introduced into the pressure cabin to effect cabin ventilation. The cabin supply is ducted from the intake and fed into the cabin through an electrically-operated ram air valve and a check valve. The ram air valve is operated by a RAM AIR OPEN (ON)-CLOSE (OFF) switch, on the roof panel CG.

The ram air passing through the refrigeration unit heat exchanger, assisted by a fan driven by the refrigeration unit turbine, is ducted to atmosphere through a grille in the rear equipment bay door.

In the event of the intake becoming obstructed, a spring-loaded door in the intake duct opens inwards to permit air from the rear equipment bay to enter the duct and supply the refrigeration unit heat exchanger.

### D. Rear equipment bay ventilation

A tapping is taken from the dorsal fin air intake to provide an air supply for rear equipment bay ventilation.

### E. Ground air conditioning

An auxiliary power unit (see Chapter 49) supplies air for ground air conditioning, the supply air being fed into the air conditioning distribution system through an electrically-operated shut-off valve and a non-return valve. The valve is controlled by an APU ON-OFF switch situated on the PRESSN and AIR CONDITIONING section of the roof panel CG.

### F. Indication

The air supply is monitored by the following indications:-

On centre instrument panel CC, red annunciators HP AIR 1-O/HEAT and HP AIR 2-O/HEAT light when actuated by temperature switches, set at 315°C, installed in each duct between the main air valve and check valve.

On centre instrument panel CC, red annunciators PYLON 1 O/HEAT and PYLON 2 O/HEAT light when actuated by overheat detectors, set at 150°C, installed in each pylon fillet, and REAR BAY O/HEAT, which lights when actuated by detectors, set at 100°C, in the rear equipment bay (see Chapter 26, FIRE/OVERHEAT DETECTION AND WARNING).

On PRESSN and AIR CONDITIONING section of roof panel CG, magnetic indicators MAIN AIR VALVE 1 and 2 which show SHUT or OPEN.

* * *

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# PIPES AND DUCTING - MAINTENANCE PRACTICES

## 1. Removal/Installation

Equipment required :-

| | |
|---|---|
| Torque tool .. .. .. | Capable of 25-50 lb.in. |

### A. General

NOTE : The following operations are applicable whenever ducting or components are removed and installed.

(1) Disconnect couplings and/or slacken hose clamps before slackening supports.

(2) Adequately support ducting and components during removal and installation.

(3) Blank off any ducts or components left open after disconnection operations.

(4) Prior to installation, ensure the absolute cleanliness of ducts, mating flanges and components.

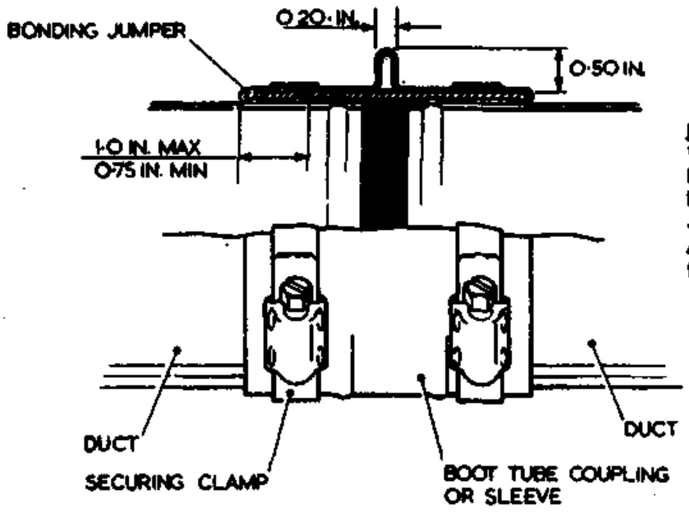
(5) Check seals for damage and deterioration.

(6) Ensure that mating flanges are smooth and flat.

(7) Ensure that joint mating flanges are mated and in alignment.

(8) Ensure that duct lagging has not deteriorated and that it is firmly secured.

(9) Connect any electrical bonding that has been disconnected during dismantling operations. For bonding of flexible joints, see Fig.201.



NOTE:
WHEN ASSEMBLING THE JOINT, ENSURE THAT THE SLEEVE OR BOOT TUBE IS CENTRAL TO THE JOINT GAP AND THE CLAMPS ARE CLEAR OF THE TUBE BEADING.

Electrical bonding - Flexible joints
Fig.201

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(10) Ensure that ducting is correctly clamped or bracketed to adjacent structure, and that no chafing is likely to occur.

(11) Ensure that ducting and securing clamps are clear of all control cables and cable adjusters, when controls are operated through their full range.

(12) Ensure that ducts are not under strain when clamped.

(13) Torque load V-clamp bolts to 45 ± 5 lb.in. (Mod.25/2180) or 45-50 (Pre-Mod.25/2180).

NOTE : Torque load V-clamps of LP and HP bleed air supply ducts, located in left and right-hand pod fillets to 35-45 lb.in.

(14) Torque load hose clamp securing bolts to 25-30 lb.in. except where specific torque loadings are quoted in individual maintenance practices.

B. Install engine LP air connector on left or right engine

(1) Fit new sealing gasket. Fit connector with bolts and torque tighten bolts to 25 to 30 lb.in.

C. Install engine HP air connector on left or right engine

(1) Fit new sealing gasket. Fit pipe with washers and bolts. Torque tighten bolts to 20-25 lb.in., and wire-lock.

* * *

# AIR VALVE (MAIN) - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch electric shut-off butterfly valve 321292 comprises an electromechanical rotary actuator, heat shield, and valve housing enclosing a butterfly assembly.

The actuator consists of a radio noise-free motor, friction brake, limit switches, gear train, linkage, and output shaft. The gear shaft supports a cam which actuates the limit switches. A pointer attached to the output shaft, in conjunction with a plate mounted on the heat shield, indicates the position of the butterfly. A receptacle is provided for the electrical system connection.

The heat shield, located between the actuator and the shut-off valve assembly reflects heat radiated from the air ducts and valve housing, thereby protecting the electrical motor and wiring.

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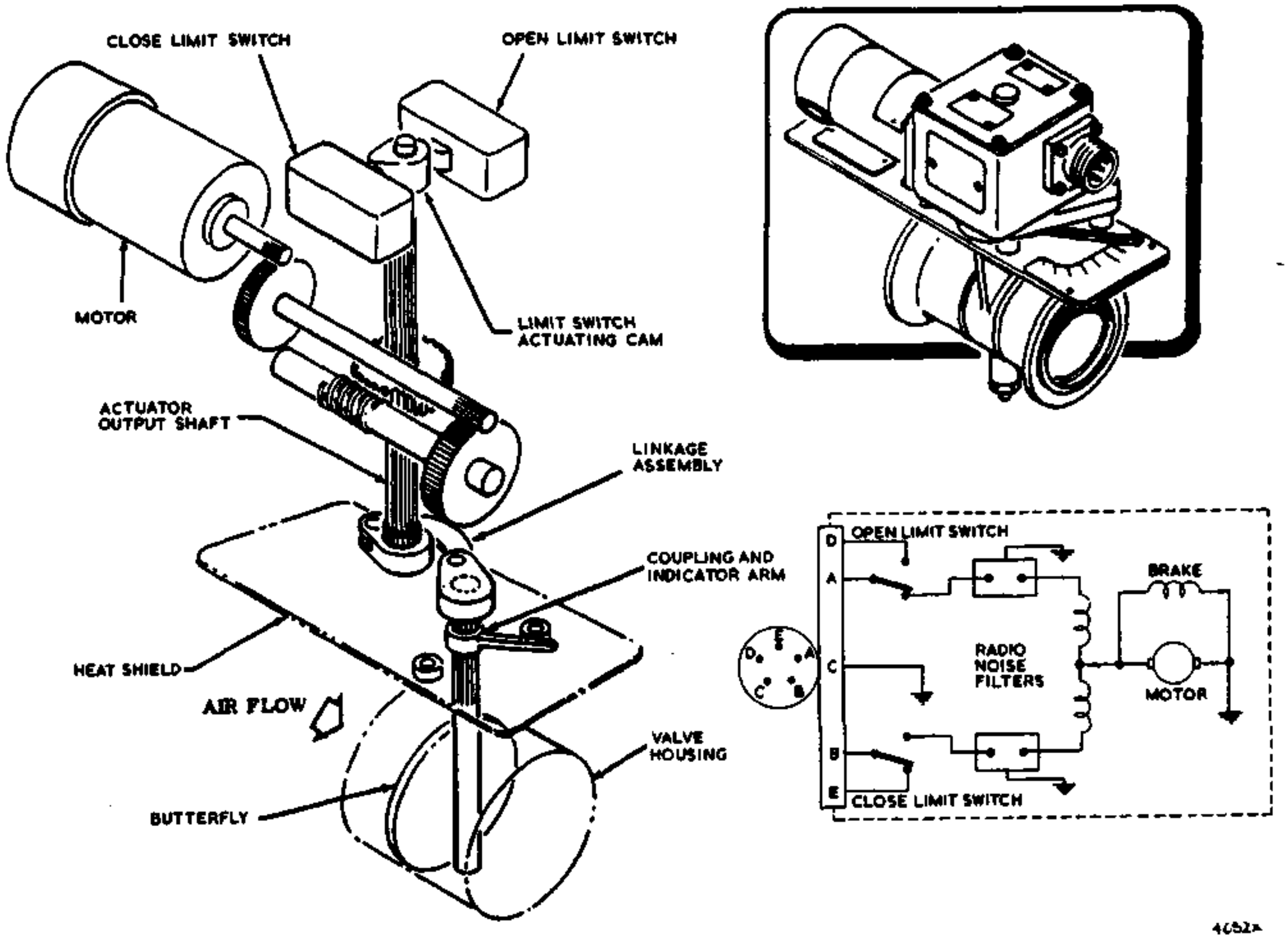

Air valve
Fig.1

...Air valve (Main) - Description continued

The valve housing serves as an air duct and is flanged at each end for installation into a pneumatic system. An arrow cast as part of the housing indicates direction of airflow.

The butterfly assembly is within the valve housing. It consists of a butterfly mounted between two plates attached to a shaft. The shaft engages the output shaft of the actuator at one end and is supported on a ball bearing at the other. Position of the butterfly assembly within the duct is controlled by adjustment of a screw beneath the ball bearing.

## 2. Operation

When the motor is energized, the output shaft of the motor drives the gear train to rotate the actuator output shaft. The rotary motion of the actuator output shaft is transmitted through the linkage assembly to the coupled butterfly shaft. The linkage assembly provides a regulated movement of the butterfly in relation to actuator output shaft rotation. Butterfly movement continues until the limit switch actuating cam operates the appropriate limit switch, thereby de-energizing the motor circuit.

With power applied through receptacle pins 'A' and 'C', the motor drives the gear train to rotate the butterfly toward the open position. The limit switch actuating cam operates the open limit switch to de-energize the motor circuit when the butterfly is fully open. With power applied through receptacle pins 'B' and 'C', the butterfly is rotated toward the closed position, and the close limit switch is actuated to de-energize the motor circuit when the butterfly is fully closed.

In addition to full actuation in either direction, the butterfly can be modulated, on demand, to any position between fully open and fully closed. The gear train and the magnetic friction brake hold the butterfly at any selected position until the motor is energized.

## 3. Data

| | |
|---|---|
| Duty Cycle .. .. .. .. | 1 min. on, 4 min. off |
| Operating time .. .. .. | 10 to 14 sec. |
| Actuator .. .. .. .. | |
| Connections | |
| Pin A .. .. .. .. | Open |
| Pin B .. .. .. .. | Close |
| Pin C .. .. .. .. | Earth |
| Pin D .. .. .. .. | Energized when valve is full-open |
| Pin E .. .. .. .. | Energized when valve is full-closed |
| Operating voltage .. .. .. | 26 ± 2 V.d.c. |
| Rated load current .. .. .. | 1.0 AMP (MAX) at 26 V.d.c. |

* * *

## AIR VALVE (MAIN) - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Leakage at ducting connection | Connections loose or defective | Tighten connection or renew defective component |
| Erratic or sluggish operation | Electrical connection loose or defective | Tighten connection or renew defective component |
| | Butterfly binding | Renew unit |
| Unit operates in only one direction | Actuator defective | Renew unit |
| Unit inoperative | Electrical connection loose or defective | Tighten connection or defective component |
| | Actuator defective | Renew unit |
| | Butterfly seized in housing | Renew unit |

* * *

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## AIR VALVE (MAIN) - MAINTENANCE PRACTICES

### 1. Removal/Installation

Equipment required :-

Torque spanner .. .. .. Capable of 40-50 lb in.

### A. Remove valve

(1) On panel DA/D, trip circuit breaker MAIN AIR VALVE 1 or 2 (grid ref.E9 or E10) as applicable.

(2) Disconnect electrical cable socket-plug from the valve socket.

(3) Release clamps securing valve to duct and bellows assembly. Remove valve and seals.

(4) Fit blanks to valve, duct and bellows assembly.

### B. Install valve

(1) Remove blanks from valve, duct and bellows assembly.

(2) Position valve so that the arrow on the valve body indicates direction of airflow, fit serviceable seals, and secure valve to duct and bellows assembly using clamps. Torque-load V-clamp bolt nuts to 40-50 lb in.

NOTE : It is permissible to rotate the valve about its lateral axis to clear pipe runs.

(3) Connect socket-plug to the valve socket.

(4) Reset circuit breaker.

### C. Checks/Tests after installation

(1) Start an engine and set throttle to ground idle (see Chapter 71, POWER PLANT - GENERAL).

(2) CAUTION : DUE TO THE DANGER OF OVERHEATING, VALVE OPERATION MUST BE LIMITED TO A MAXIMUM DURATION OF ONE MINUTE FOLLOWED BY A REST PERIOD OF FOUR MINUTES.

Operate respective MAIN AIR VALVE selector switch to OPEN, and check that the valve motors to the fully open position in 10 to 14 seconds, and that the related MAIN AIR VALVE indicator shows OPEN.

(3) Check valve joints, by feel of hand, for leaks.

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...Air valve (Main) - Maintenance practices continued

(4) Operate MAIN AIR VALVE selector switch to CLOSE, and check that the valve motors to the fully closed position, and the MAIN AIR VALVE indicator shows SHUT.

(5) Shut down engine (see Chapter 71, POWER PLANT - GENERAL).

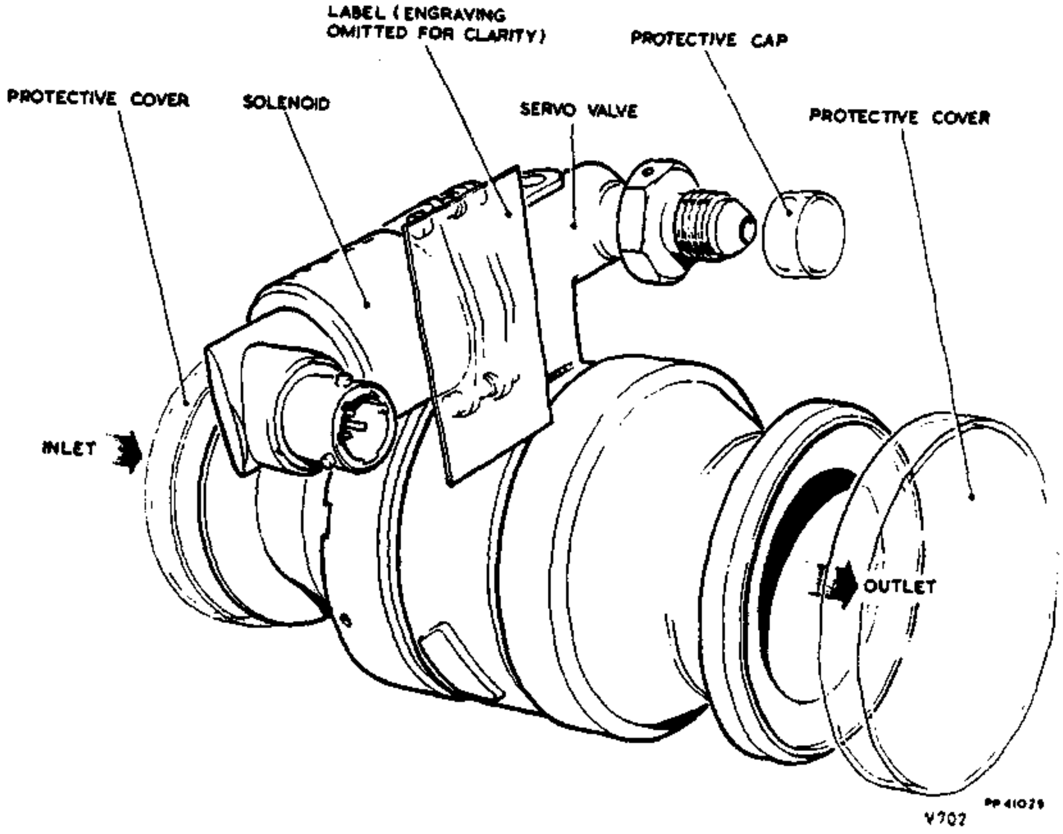
* * *

# AIR VALVE (HP) - DESCRIPTION AND OPERATION

## 1. Description

The High Pressure Air Valve has no attachment points. It is installed directly in the aircraft high pressure ducting into the Mixer valve. The HP air valve contains a spring loaded piston which moves on a hollow shaft to open or close the inlet. The operation of the valve is controlled by a solenoid and a servo valve. These are both part of the valve assembly.

The solenoid circuit is shown in Fig.3 and includes two diodes. One diode, in the positive line, provides protection against reverse polarity. The other diode is fitted across the solenoid to prevent voltage spike.



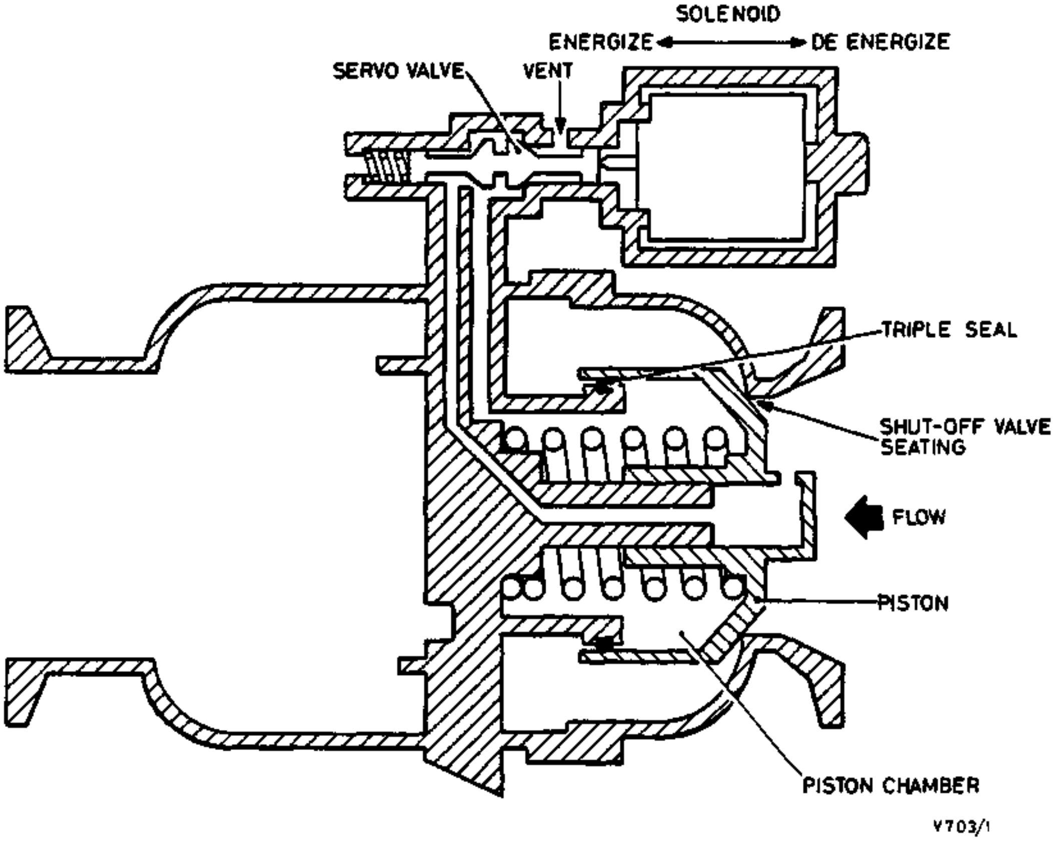
Air valve (HP)
Fig.1

## 2. Operation

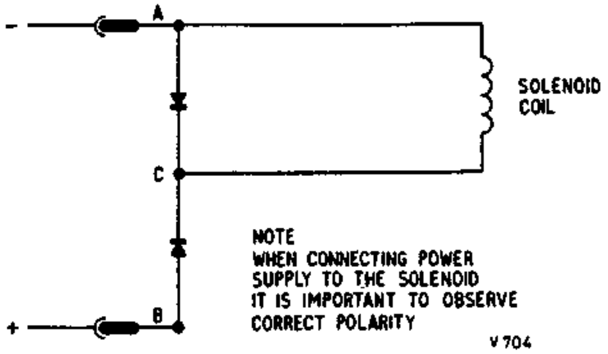
With no pressure in the ducting upstream of the air valve, the shut-off valve stays closed by the spring inside the piston.

With pressure upstream of the valve, when the solenoid is energized the servo valve is held open against the spring. The action opens the vent to ambient from the piston chamber and the upstream pressure supply is shut off from the piston chamber. With upstream pressure acting on the upstream side of the piston and ambient pressure on the downstream side of the piston, the valve is held open against its spring.

When the solenoid is de-energized, the servo valve is moved to its other position by the spring, and closes the vent to ambient from the piston chamber. The servo valve movement also allows upstream air pressure to pass down the centre shaft and through the servo valve to the piston chamber. The shut-off valve seat is smaller in diameter than the overall diameter of the piston, consequently air pressure in the piston chamber reacts on a larger area than that of the valve seat. Pressure differential, therefore, assisted by spring force, closes the shut-off valve.



Schematic diagram
Fig.2



NOTE
WHEN CONNECTING POWER SUPPLY TO THE SOLENOID IT IS IMPORTANT TO OBSERVE CORRECT POLARITY

Circuit diagram of solenoid
Fig.3

## 3. Data

NOTE: Mod.253532 introduces a new HP air valve. The post-mod.253532 HP air valve has the same operating data as the pre-mod.253532 HP air valve and is an equivalent alternative.

| | |
|---|---|
| HP air valve (pre-mod.253532) | Pt.No.B01-A2-14128A (HSD) |
| HP air valve (post-mod.253532) | Pt.No.MAP-900-001 (Hymatic) |
| Operating air flow (maximum) | 20 lb/min. |
| Operating air pressure (max.) upstream | 280 lbf/sq.in. gauge |
| Operating voltage | 28V DC at 0.19 amp max. |
| Weight | 1.82 lb. |

* * *

## MIXING VALVE (LP/HP) - DESCRIPTION AND OPERATION

### 1. Description (Fig.1)

The bleed air mixing valve consists of a high stage pressure regulator, high stage valve body assembly, check valve, low stage valve body assembly, outlet valve body, and a reference regulator and temperature compensator.

The high stage pressure regulator consists of a spring-loaded closed poppet valve and diaphragm arrangement. The high stage pressure regulator compares regulated compressor high stage bleed pressure to ambient pressure.

The high stage valve body assembly provides a seat for the poppet valve and is bolted to the high stage pressure regulator and the low stage valve body assembly. A high pressure inlet test port is provided for customer use, and a filter is provided to prevent foreign particles from entering the internal passages.

The check valve consists of two flapper plates hinged on a single hinge pin in a check valve body. The flapper plates are torsion spring-loaded closed. The check valve allows air flow in one direction only.

The low stage valve body assembly houses the check valve, and is bolted to the outlet valve body and the high stage valve body assembly.

The reference regulator and temperature compensator consists of a reference regulator which may be actuated by the temperature compensator.

The reference regulator consists of a spring-loaded closed poppet valve arrangement. The reference regulator senses compressor high stage bleed pressure and ambient pressure.

The temperature compensator consists of bimetallic washers and an actuating piston which is spring-loaded away from the reference regulator poppet valve. The bimetallic washers change in spring tension with temperature changes.

### 2. Operation (Fig.2)

NOTE : The bleed air mixing valve is shown with no compressor low stage or high stage bleed air applied.

When the compressor low stage bleed air pressure becomes sufficient to open the check valve, air is routed out through the outlet valve body.

Compressor high stage bleed air is routed through a filter to the reference regulator and the high stage pressure regulator. When the air pressure reaches a predetermined value, the reference regulator poppet valve will unseat, and vent compressor high stage bleed pressure to maintain a constant pressure in the high stage pressure regulator. The pressure in the high stage pressure regulator will unseat the poppet valve, and allow compressor high stage air to be mixed with the compressor low stage air at the outlet valve body.

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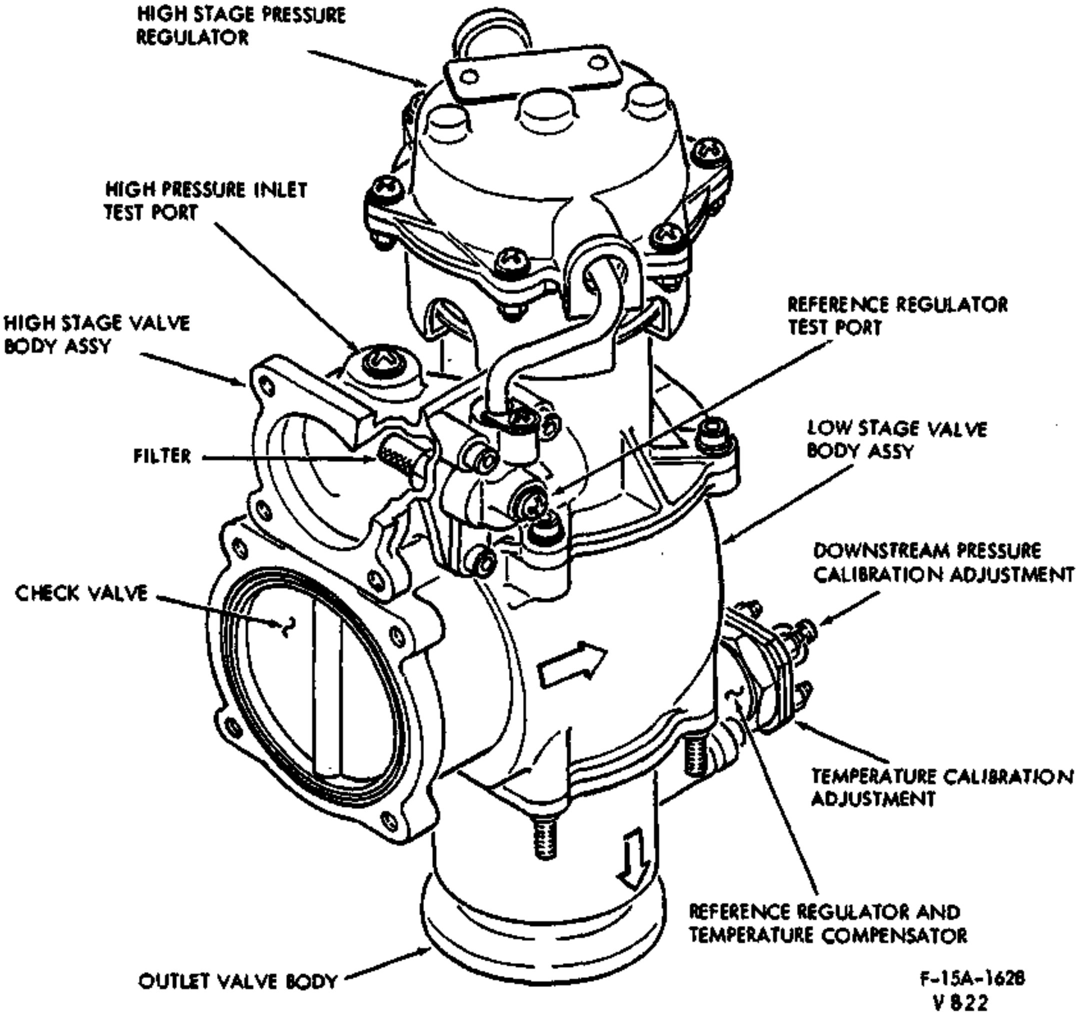
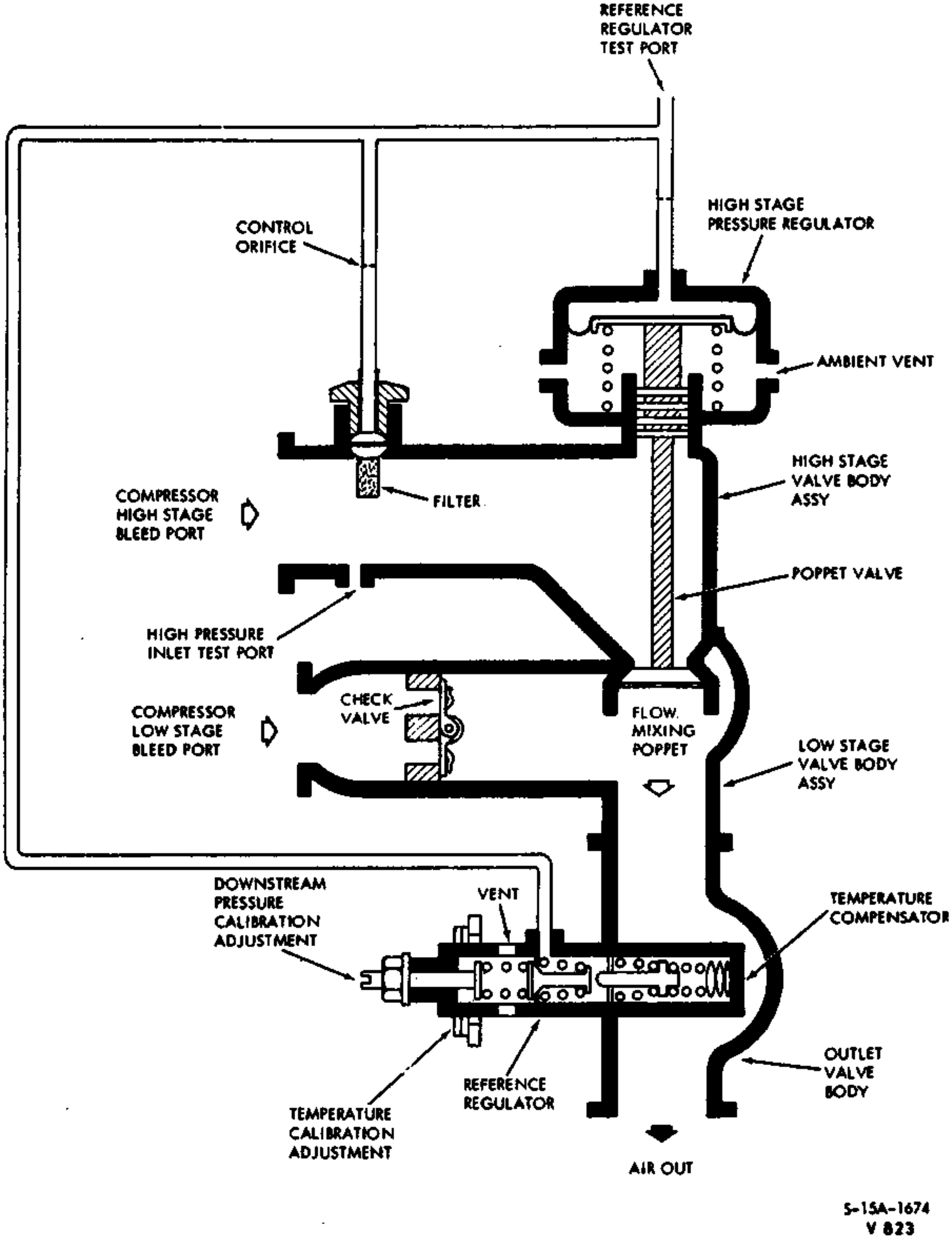

HIGH STAGE PRESSURE REGULATOR
HIGH PRESSURE INLET TEST PORT
HIGH STAGE VALVE BODY ASSY
FILTER
CHECK VALVE
REFERENCE REGULATOR TEST PORT
LOW STAGE VALVE BODY ASSY
DOWNSTREAM PRESSURE CALIBRATION ADJUSTMENT
TEMPERATURE CALIBRATION ADJUSTMENT
REFERENCE REGULATOR AND TEMPERATURE COMPENSATOR
OUTLET VALVE BODY
F-15A-1628
V 822

Mixing valve - assembled view
Fig.1

...Mixing valve (LP/HP) - Description and operation continued



Mixing valve - schematic view
Fig.2

...Mixing valve (LP/HP) - Description and operation continued

Downstream pressure is sensed on the poppet valve and acts against the reference pressure in the pressure regulator to modulate the poppet position and maintain the desired downstream pressure. When the low stage pressure exceeds the desired minimum, the poppet valve will be fully closed.

When the outlet air temperature exceeds a predetermined value, the bimetallic washers of the temperature compensator will increase spring tension sufficiently to cause the actuating piston to open the poppet valve of the reference regulator in proportion to the overtemperature. This increases the bleed off of the compressor high stage reference regulator resulting in a decrease in the pressure in the high stage pressure regulator. Spring force closes the poppet valve in proportion to the overtemperature.

When air pressure is removed from the compressor high stage bleed port, spring force drives the poppet valve closed. When compressor low stage bleed pressure drops below the forces of the torsion springs of the check valve, the check valve closes, to prevent reverse airflow.

## 3. Data

| | |
|---|---|
| Check valve operation | |
| Maximum crack pressure .. .. .. | 0.2 lb/sq.in. |
| Reverse port leakage .. .. .. | 0.2 pound per minute maximum at 50 p.s.i.g. and 27°C (80°F). |
| High stage pressure regulator | |
| Minimum opening pressure .. .. | 14 p.s.i.g. |
| Flow range .. .. .. .. | 20 pounds per minute |
| Outlet pressure with high stage open .. | 18 to 22 p.s.i.g. |
| Temperature compensation mode operation .. | Normally 200°C |
| Weight .. .. .. .. | 6 lb max. |

* * *

# MIXING VALVE (LP/HP) - MAINTENANCE PRACTICES

## 1. Removal/Installation

Equipment required :-

| | |
|---|---|
| Torque spanner .. .. .. .. | Capable of 35 to 50 lb.in. |

### A. Removal

(1) Open access door to rear equipment bay.

(2) Remove clamp securing air bleed duct to mixing valve.

(3) Disconnect rudder bias pipeline from adapter on firewall pan.

(4) Release fasteners and remove access panel in pylon fillet.

(5) Remove clamps from LP and HP ducts.

(6) Position operator inside fuselage to support mixing valve.

(7) Remove 13 bolts securing firewall pan to rib.

(8) Remove mixing valve assembly.

(9) Remove heat shields.

(10) Remove rudder bias pipe adapter from LP duct.

(11) Remove bolts securing LP and HP ducts; discard O-rings, Lo-load seals and tab washers; remove mixing valve.

### B. Preparation of replacement component

(1) Install firewall pan with LP and HP ducts to new mixing valve. Use new O-rings at LP duct, and new Lo-load seals at HP duct on each side of seal plate. Install bolts with new tab washers. Tighten bolts evenly and lock with tab washers.

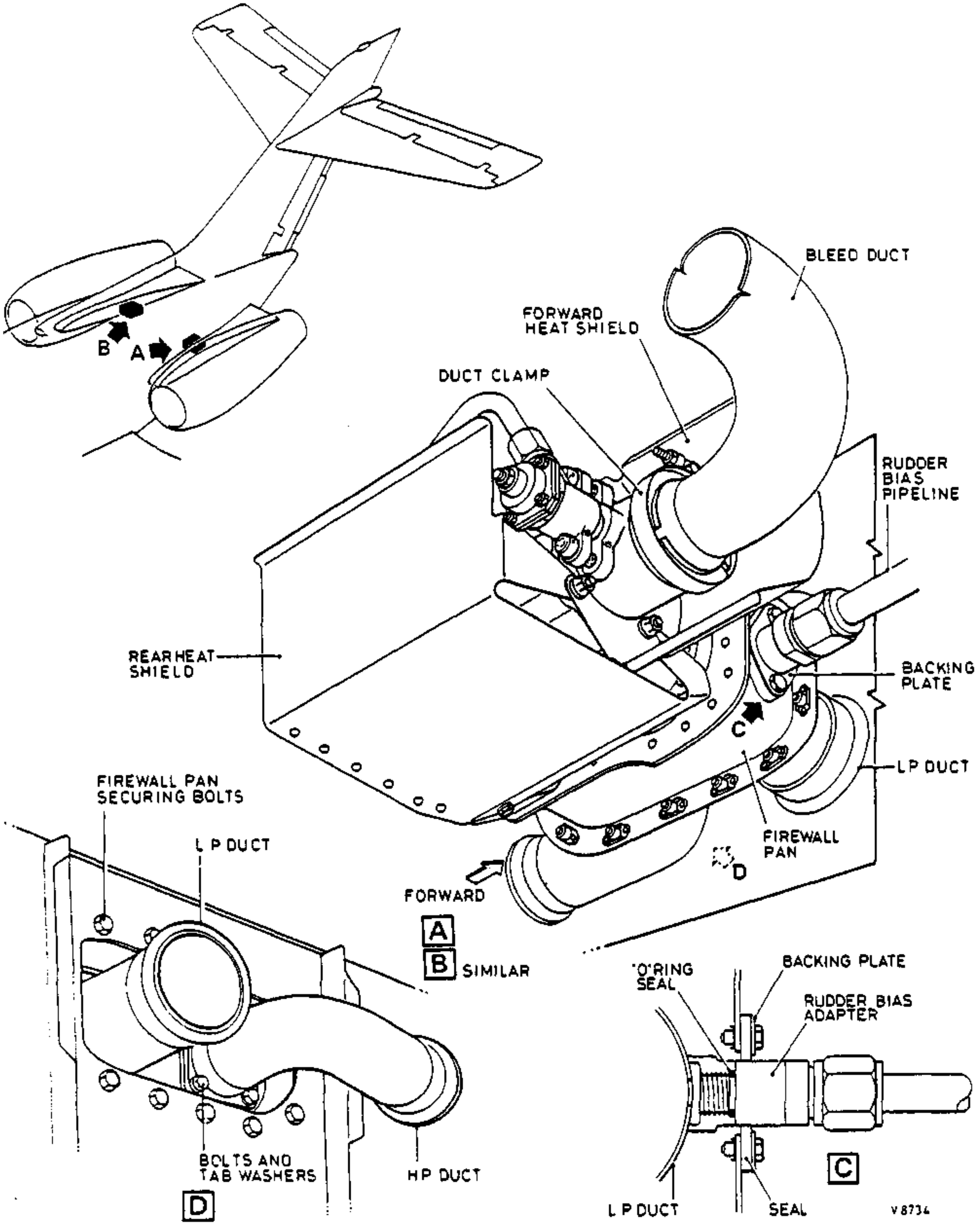
(2) Install adapter into LP duct with new O-ring, and fit seal and backing plate with 2 bolts. Wire-lock adapter to drilled bolthead.

(3) Install rear heat shield then forward shield with washers on studs where rear heat shield lugs do not fit. Secure with stiffnuts.

### C. Installation

(1) Position mixing valve assembly and secure with 13 bolts.

(2) Install clamp, with new seals, to LP duct. Torque load clamp to 35-45 lb.in.



Mixing valve installation
Fig.201

(3) Install clamp, with new seal, to HP duct. Torque load clamp to 35-40 lb.in.

(4) Install clamp, with new seal, to valve outlet and air bleed duct. Torque load clamp to 40-50 lb.in.

(5) Connect rudder bias pipeline to adapter and wire-lock.

### D. Checks/Tests after installation

(1) Run relevant engine at idle (see Chapter 71, POWER PLANT - GENERAL).

(2) Select relevant main air valve to OPEN, and check all distrurbed joints for leaks.

(3) Select main air valve to CLOSE.

(4) Stop engine (see chapter 71, POWER PLANT - GENERAL).

(5) Close and secure access panel and rear equipment bay door.

## 2. Adjustment/Test

### A. Test operation of mixing valves

Equipment required:-

Pressure gauge .. .. 0 to 100 lb/sq.in.
Avometer 8 (or equivalent), or 30V d.c. voltmeter

(1) Disconnect hydraulic reservoir pipeline from adapter in left bleed air duct, and connect pressure gauge to air duct adapter.

(2) Remove panel on underside of left pylon and disconnect electrical connector from left HP air valve.

(3) Ensure left main air valve is closed and remove its electrical connector.

(4) Start left engine and run at idle (see Chapter 71, POWER PLANT - GENERAL).

(5) Check continuity between HP air valve connector pin A and local aircraft earth.

(6) Slowly increase engine rev/min and check that the HP air valve low pressure switch contacts open, giving an open circuit between HP air valve connector pin A and local aircraft earth, before the pressure exceeds 31 lb/sq.in. (approx 75% N1).

(7) Slowly reduce engine rev/min and check that the HP air valve low pressure switch contacts close, giving continuity between HP air valve connector pin A and local aircraft earth, when the pressure is between 24 and 30 lb/sq.in.

(8) Reconnect left HP air valve.

(9) With engine speed at idle, check that pressure gauge reads less than 5 lb/sq.in.

(10) Select left main air valve to LP ON and check that the pressure gauge reading does not increase.

(11) Select left main airvalve to OPEN and with engine at idle:-

(a) Check that the pressure gauge reads between 15 and 22 lb/sq.in.
(b) Select left main air valve to CLOSE and check that the pressure reduces to less than 5 lb/sq.in.

(12) Reconnect main air valve.

(13) Select left main air valve to OPEN, and check that valve opens.

(14) Increase engine rev/min to 50% N1, and check that the N2 setting is between 76-80%. Check that pressure gauge reads between 17 and 23 lb/sq.in.

(15) Reduce engine speed to idle, and select left main air valve to CLOSE.

(16) Stop engine (see Chapter 71, POWER PLANT - GENERAL).

(17) Remove pressure gauge.

(18) Connect hydraulic reservoir pipeline to adapter in left bleed air duct and wire-lock.

(19) Refit and secure access panel on underside of pylon.

(20) Ensure that the flt. deck heat valve is closed, and repeat operations (1) to (19) reading right for left.

* * *

# REFERENCE REGULATOR/TEMPERATURE COMPENSATOR - MAINTENANCE PRACTICES

Allied Signal Aerospace Equipment Systems have discontinued the practice of repairing, overhauling or selling the reference regulator/temperature compensator for installing to the bleed air mixer valve. The combined assembly will now be serviced as one unit.

For the description and operation of the reference regulator/temperature compensator assembly, refer to MIXING VALVE (LP/HP) - DESCRIPTION AND OPERATION.

# CHECK VALVE (AUXILIARY SUPPLY) - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch check valve 123188 consists of two semi-circular, spring-loaded, normally closed flappers hinged on a pin extending through the centre of the valve body normal to the airflow axis. Normal direction of airflow is indicated by an arrow cast into the side of the valve body.

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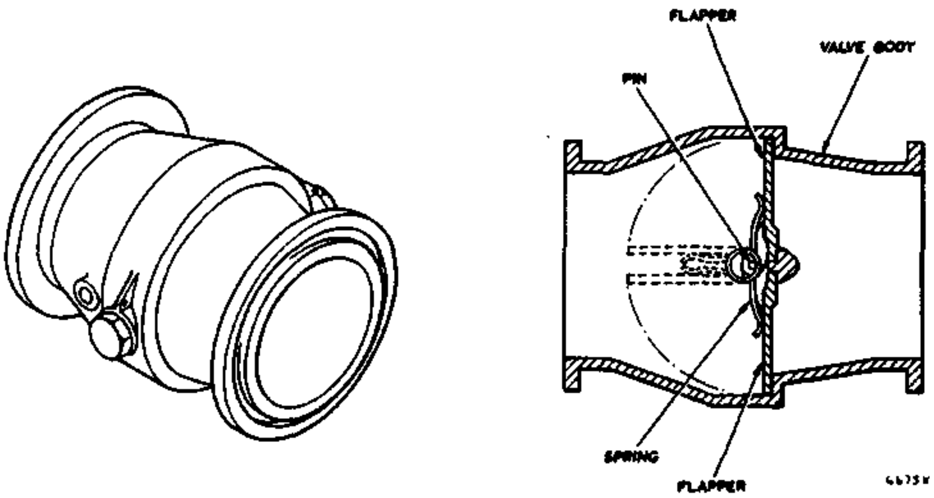

Check valve
Fig.1

## 2. Operation

Air pressure on the upstream side of the check valve acts upon the surfaces of the flappers, overcomes the spring force, and moves the flappers toward the open position, allowing normal airflow. If airflow is reversed, spring force closes the flappers, shutting off the flow of air until the upstream-to-downstream air pressure differential is sufficient to re-open the flappers.

## 3. Data

Maximum operating pressure ... ... ... 125 lb/sq.in.g.

* * *

## CHECK VALVE (AUXILIARY SUPPLY) - MAINTENANCE PRACTICES

### 1. Removal/Installation

General

On installation ensure that V-clamp bolt nuts are torque-tightened to 40-50 lb.in.

* * *

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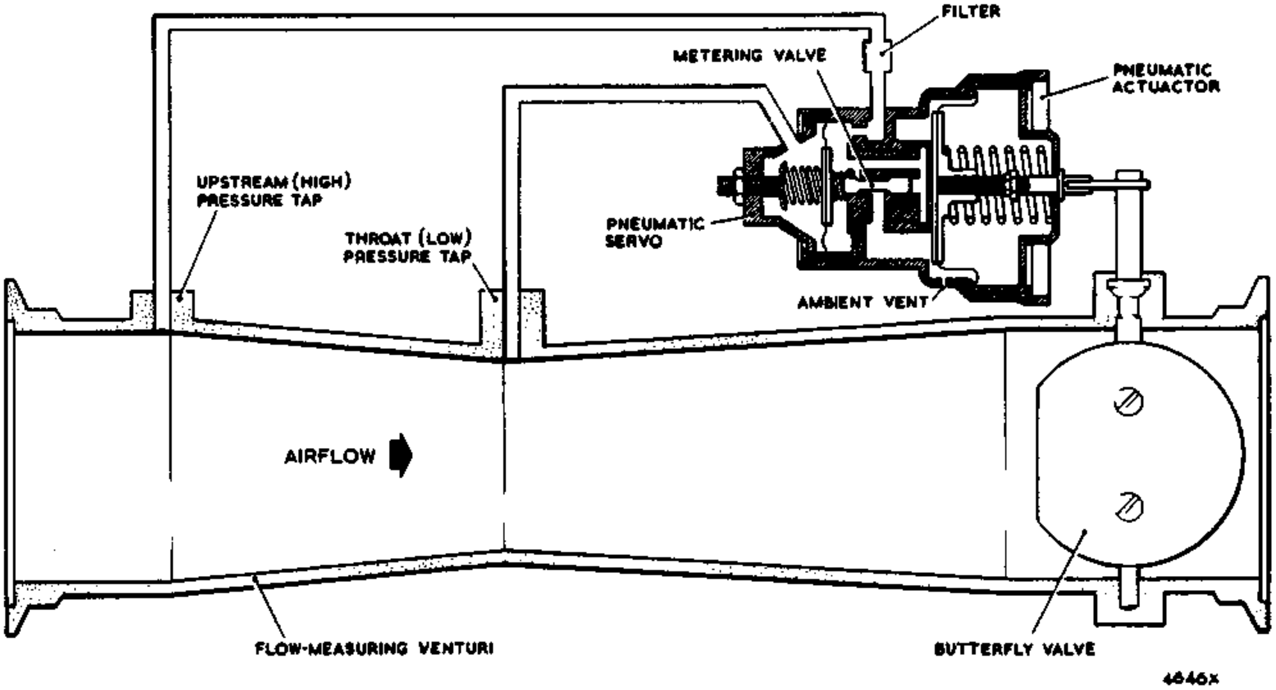
# FLOW CONTROL VALVE - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch airflow control 106884 has as its principal elements a flow-measuring venturi in series with, and upstream of, a butterfly valve, a servo assembly consisting of a pneumatic servo and a pneumatic actuator for the butterfly valve.

The pneumatic servo consists of an upstream pressure chamber and a throat pressure chamber separated by a spring-loaded diaphragm. The diaphragm positions a spring-loaded metering valve to meter upstream pressure air to the pneumatic actuator chamber.

The pneumatic actuator consists of an actuator diaphragm that separates an ambient pressure chamber and an actuator pressure chamber. The actuator diaphragm is connected by linkage to the butterfly valve and is spring-loaded to hold the butterfly valve normally open.



Flow control valve
Fig.1

## 2. Operation

Air flow through the unit creates a differential pressure from the upstream pressure and throat pressure taps of the airflow venturi. Upstream pressure is applied to one side of the servo diaphragm, while throat pressure is applied to the opposite side of the servo diaphragm.

...Flow control valve - Description and operation continued

When a greater differential pressure than the calibrated value is sensed by the servo diaphragm, the diaphragm moves to position the metering valve to increase upstream air pressure to the actuator pressure chamber of the pneumatic actuator. As pressure in the actuator pressure chamber increases, it moves the actuator diaphragm, causing the butterfly valve to move toward the closed position and limiting airflow through the venturi.

When lesser differential pressure that the calibrated value is sensed by the servo diaphragm, the diaphragm moves the position of the metering valve to throttle upstream air pressure to the actuator pressure chamber of the pneumatic actuator. Residual pressure in the actuator pressure chamber is reduced through the ambient vent. This changes the force balance across the actuator diaphragm and the spring acts to retract the butterfly actuator shaft, opening the butterfly valve and increasing air flow through the venturi to the required value.

* * *

## FLOW CONTROL VALVE - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Unit fails to control air flow | Tubing or ducting connections leaking<br>Ambient vent in pneumatic actuator clogged | Check and tighten connections<br>Clean vent, being careful not to enlarge hole. (Do not attempt to clean obstruction with compressed air, since this may rupture the diaphragm) |
| Air flow control is erratic | Servo out of calibration<br>Metering valve out of adjustment | Renew complete unit<br>Renew complete unit |

* * *

# FLOW CONTROL VALVE - MAINTENANCE PRACTICES

## 1. Procedure

| Equipment/Materials | Part/Item No. |
|---|---|
| Cleaning solvent (white spirit) | 219 (Chapter 20-95-201) |
| Torque spanner | Capable of 65-75 lbf.in (pre Mod.252180)<br>Capable of 40-50 lbf.in (Mod.252180) |
| Clamp seal | 6-464-2PAR (V72433) |
| Pressure gauge | Direct reading 0-5 psi |

### A. Removal

(1) Release the clamps securing the valve to the ducting, remove the valve and the seals.

(2) Install blanks to the ducts.

### B. Cleaning

**WARNING: DO NOT USE THE CLEANING FLUID NEAR FLAMES. USE THE CLEANING FLUID IN AN AREA WHICH HAS GOOD VENTILATION AND DO NOT BREATH THE FUMES.**

(1) Clean the inside of the venturi with white spirit, Item 219

(2) Use a lint-free cloth and make sure the inside of the venturi is clean and dry

### C. Inspection/check

(1) Make sure there is no damage to the venturi butterfly linkage.

(2) Check that there is no debris in the venturi.

(3) Make sure the venturi butterfly valve has no visible damage and the valve is in the open position.

(4) Disconnect the upstream pressure tube and filter assembly between the venturi and the pneumatic servo.

(5) Put a dry air pressure of approx. 20 psi at the venturi end of the tube and filter assembly and make sure there is no blockage.

(6) Disconnect the throat pressure tube assembly between the venturi and the pneumatic servo.

(7) Put a dry air pressure of approx. 20 psi at the venturi end of the tube assembly and make sure there is no blockage.

(8) Connect the upstream and throat pressure tubes to the venturi and the pneumatic servo.

### D. Installation

(1) Remove the blanks from the ducts.

(2) Position the valve so that the flow arrow on the valve body points in the direction of airflow. Install serviceable seals and secure the valve to the ducting with the clamps. Torque tighten clamp nuts to 65-75 lbf.in.(pre Mod.252180) or 40-50 lbf.in.(Mod.252180).

### E. Leak test

(1) Start an engine and set the throttle to ground idle (see Chapter 71, POWER PLANT - GENERAL).

(2) Select the appropriate MAIN AIR VALVE switch to OPEN and check that the related MAIN AIR VALVE annunciator comes on.

(3) Check the flow control-valve joints for leaks.

(4) Select the MAIN AIR VALVE switch to CLOSE and check the annunciator goes off.

(5) Shut down the engine (see Chapter 71, POWER PLANT - GENERAL).

### F. Functional test

(1) Make sure the aircraft condition is satisfactory to do an engine ground run.

(2) Disconnect the water separator flexible drain pipe from the heat exchanger discharge-duct and connect the pressure gauge to the pipe using the existing pipe clip.

(3) Start both engines and set the throttle levers to idle (see Chapter 71-00-00 POWER PLANT - ADJUSTMENT TEST).

(4) Select both air valve switches to OPEN and check:

(a) Related air valve indicator shows OPEN or

(b) Related annunciator comes on.

(5) Check for air leaks at the flow control valve joints and at the pressure gauge connection.

(6) Control the duct temperature at 25° ±5°C using the aircraft instrumentation for temperature readings.

(7) Observe and record the water-separator drain pressure. Make sure the recorded pressure is in the hatched area shown in *Figure 201*.

(8) Repeat paragraphs (6) and (7) at engine speeds of 50, 70 and 90 per cent $N_1$ rev/min.

(9) Select both air valve switches to CLOSE and check:

(a) Related air valve indicator shows SHUT or

(b) Related annunciator is off.

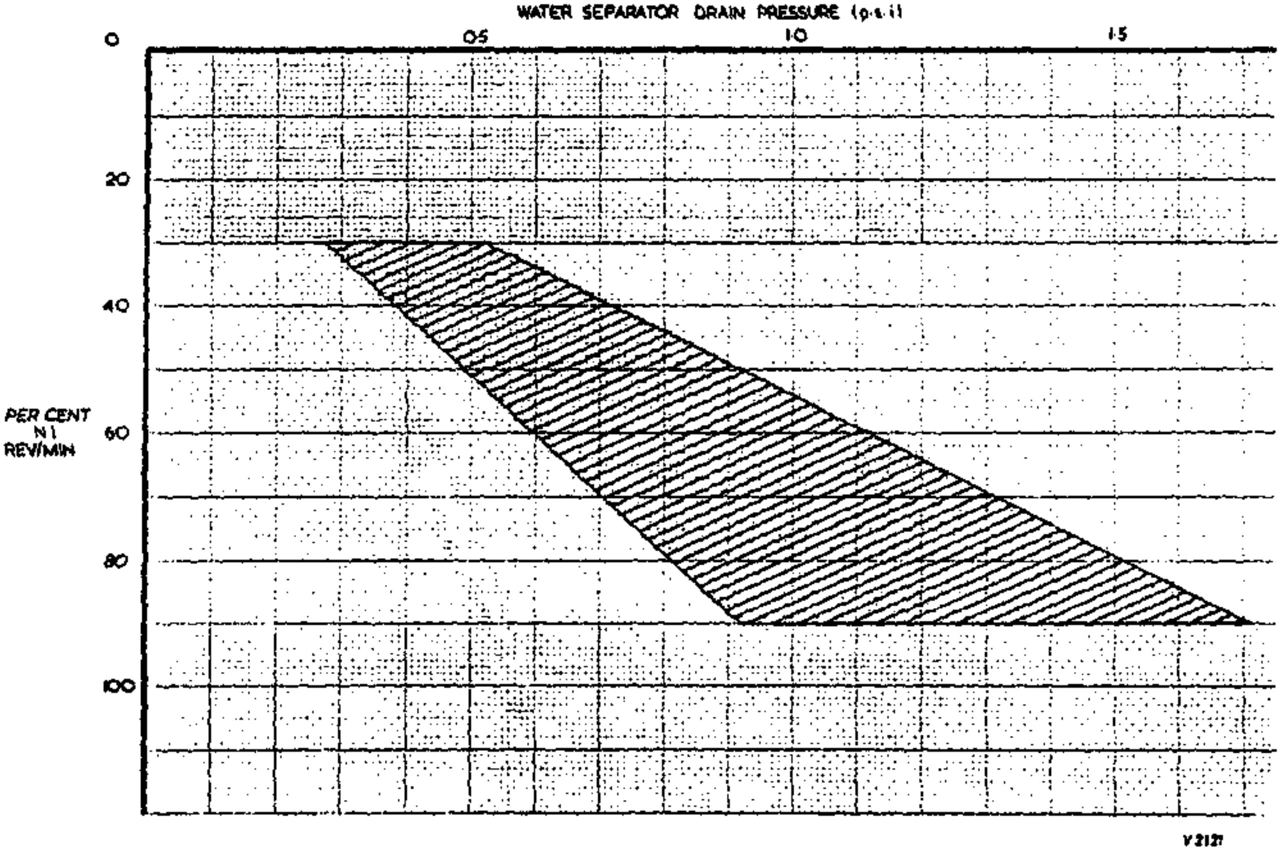
(10) Shut down the engines (Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST).

(11) Remove the pressure gauge and reconnect the water-separator drain pipe to the heat-exchanger discharge duct using existing clip.

*NOTE: If the test results are different than the limits given by Figure 201, reject the flow control valve. Replace the flow control valve and repeat the test.*

**G. Job close up**

(1) Remove all the tools, the materials and equipment. Make sure the work area is clean.



Flow control valve serviceability criteria
*Figure 201*

# REFRIGERATION UNIT - DESCRIPTION AND OPERATION

## 1. Description *(Figure 1)*

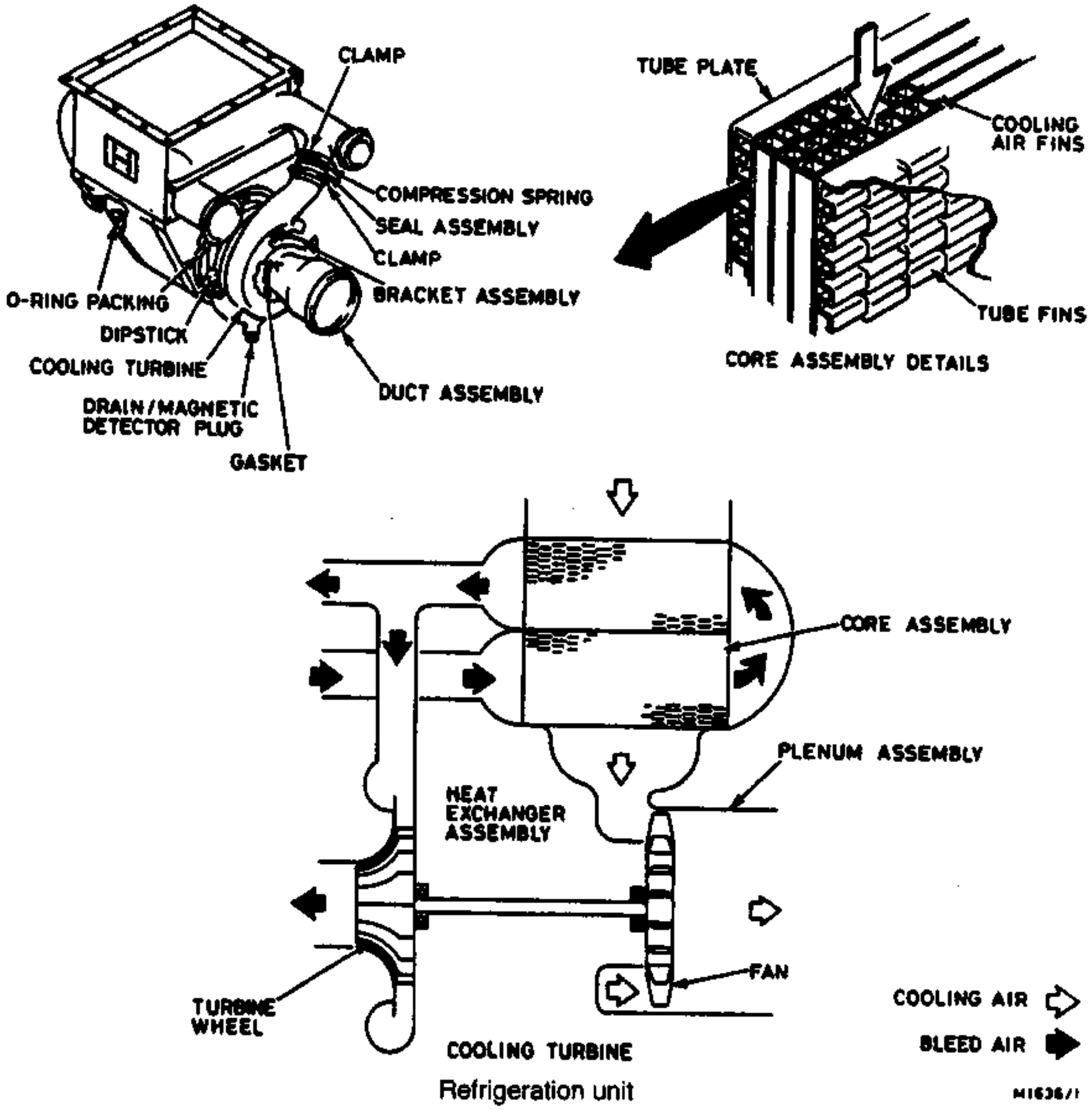
### A. General

The Allied Signal refrigeration unit has a cooling turbine and an air-to-air ducted heat exchanger assembly.

### B. Cooling turbine

The cooling turbine has a turbine wheel and a fan mounted on opposite ends of a ball-bearing supported shaft and is contained within a housing.

Lubricating oil is supplied by wicks from an oil sump to the shaft. As the shaft rotates, oil is sprayed off, forming an oil-air mist through the bearings to provide lubrication. The oil then drains to the sump.



Refrigeration unit
*Figure 1*

### C. Heat exchanger assembly

The heat exchanger plenum forms the cooling turbine mounting and encloses the fan section of the cooling turbine. The plenum also provides a channel for routing the cooling air through the fan.

The ducted heat exchanger assembly is an air-to-air type consisting of a core assembly. The core has a series of tube plates with integral tube fins and separated by cooling air fins.

The core assembly is enclosed in welded and brazed pan assemblies. The pan assemblies have integral inlet and discharge ducts for directing hot engine bleed air and ram cooling air through the refrigeration unit.

## 2. Operation

### A. General

Hot engine-bleed-air enters the heat exchanger inlet and passes through the tube plates of the core assembly. Partial cooling of the hot engine-bleed-air is effected by heat transfer through the tubing walls to ram (cooling) air flowing around the tubes.

The partially cooled engine-bleed-air is then ducted to the cooling turbine where the air is directed by the nozzle vanes to the blades of the turbine wheel. The air impinges on the blades and rotates the wheel at high speed. The air is then discharged into the outlet duct.

The energy-using process of turning the turbine wheel causes the engine-bleed-air temperature to fall. The energy used to rotate the turbine wheel is absorbed by the fan on the opposite end of the shaft. The rotation of the fan draws the ram (cooling) air through the heat exchanger assembly.

## 3. Data

### A. Lubricating oil

Recommended lubricating oil is item no.132 or 135 (Chapter 20-95-101).

## REFRIGERATION UNIT - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Refrigeration unit discharge temperature too high | Obstruction in cooling air ducts | Locate and remove obstruction |
| | Defective cooling turbine | Renew cooling turbine |
| | Defective heat exchanger assembly | Renew refrigeration unit |
| | Leaking duct joints or gaskets | Tighten loose joints |
| Oil mist in refrigeration unit discharge | Defective cooling turbine | Renew cooling turbine |

* * *

# REFRIGERATION UNIT - MAINTENANCE PRACTICES

## 1. Procedure *(Figure 201)*

| Equipment/Materials | Part/Item No. |
|---|---|
| Cleaning solvent | 219 (Chapter 20-95-201) |
| Lubrication | 132 or 135 (Chapter 20-95-101) |
| Torque spanner | Capable of 25-50 lbf.in. |
| Packing (O-ring) | Large hexagonal on the drain plug |

### A. Change oil in the cooling-turbine

(1) Position a suitable receptacle to catch the oil (approximately 200 c.c.) and remove turbine drain/ magnetic detector plug and dipstick.

(2) Make sure the magnetic detector has no metal particles.

*NOTE: A sample of the drained oil should be kept in a suitable glass container for 48 hours to allow any water held in suspension to separate out from the oil.*

*If any water is found in the sample, consideration should be given to changing the cold air unit as excessive bearing wear may have occurred.*

**WARNING: DO NOT USE THE CLEANING FLUIDS NEAR FLAMES. USE THE CLEANING FLUID IN AN AREA WHICH HAS GOOD VENTILATION AND DO NOT BREATH THE FUMES.**

(3) Clean the drain plug with cleaning solvent (Item 219) and dry thoroughly with compressed air.

(4) Fit the drain plug.

**CAUTION: DO NOT PUT TOO MUCH OIL IN THE COOLING TURBINE.**

(5) Fill the cooling turbine with oil through the dipstick opening until oil level registers 0.040 in. (marked F on the modified dipstick) above the ADD mark on the dipstick.

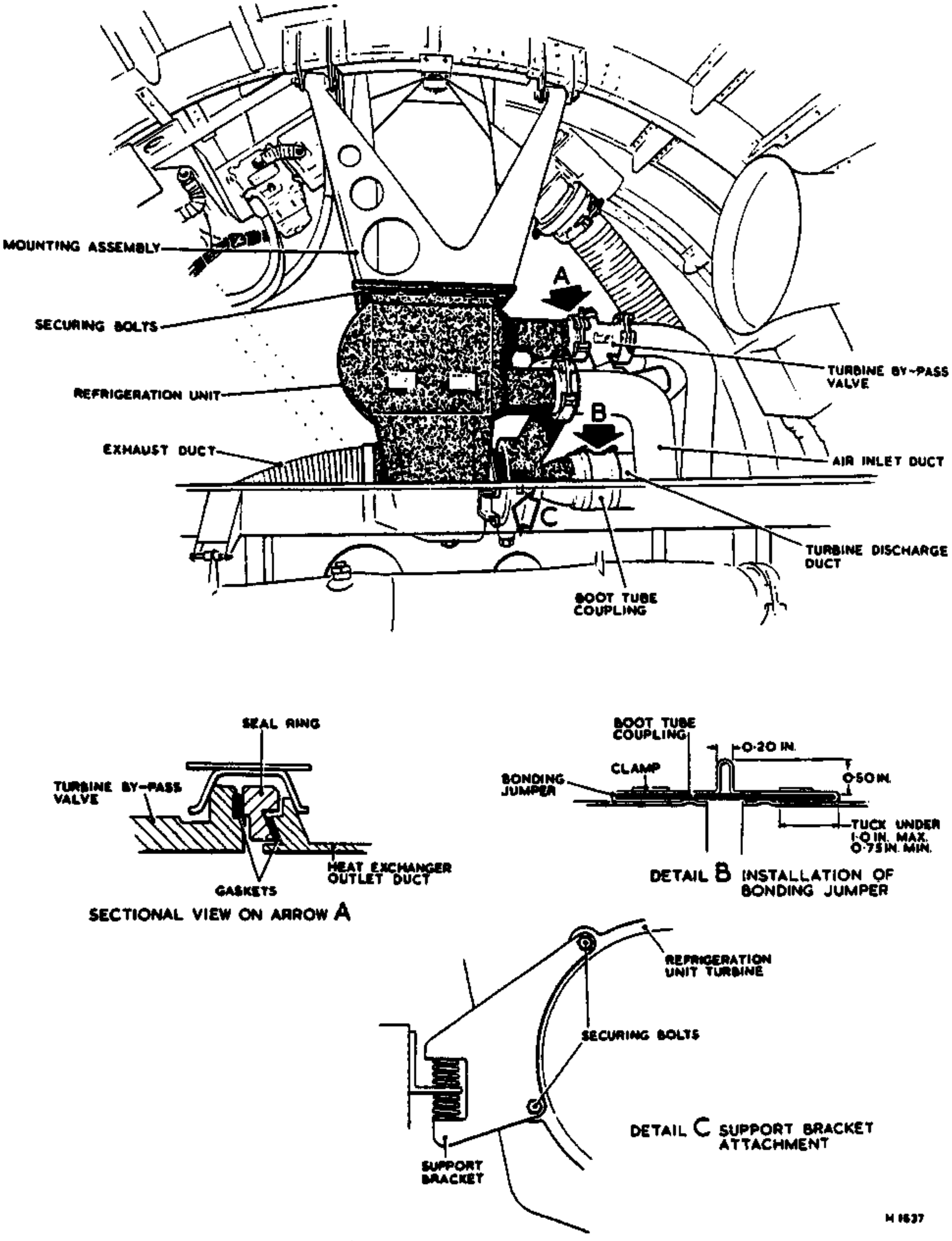
(6) Fit the dipstick.

## 2. Refrigeration Unit

### A. Removal *(Figure 201)*

(1) Slacken securing clamp and disconnect flexible exhaust duct from the unit.

(2) Remove clamp and disconnect air inlet duct from the unit heat exchanger. Keep the seal.



SECTIONAL VIEW ON ARROW A

DETAIL B INSTALLATION OF BONDING JUMPER

DETAIL C SUPPORT BRACKET ATTACHMENT

Refrigeration unit installation
*Figure 201*

(3) Slacken securing clamp and disconnect, from the unit turbine, the boot-tube coupling connecting the turbine discharge duct to the turbine.

(4) Remove the clamp and disconnect the turbine by-pass valve from the unit heat exchanger outlet. Keep the seal ring and gaskets.

(5) Remove bolts securing the unit support bracket to the turbine.

(6) Support the unit and remove bolts securing it to its mounting assembly. Remove the unit.

(7) Suitably blank off open ducts and unit connections.

(8) If the unit is not being refitted, fit the turbine securing bolts removed in paragraph (5).

**B. Inspection/check**

(1) For disassembly, inspection and assembly of the refrigeration unit refer to the Allied Signal Overhaul Manual.

**C. Installation** *(Figure 201)*

(1) Remove the two turbine securing bolts which are used to secure the unit to the support bracket.

(2) Remove blanks from the unit connections and ducting.

(3) Position unit and secure to mounting assembly using bolts, washers and nuts.

(4) Using the two bolts removed in paragraph (1), secure the unit to the support bracket; wire-lock the bolts.

(5) Connect turbine by-pass valve to the unit heat exchanger outlet using seal ring, gaskets and duct clamp; for joint assembly see *(Figure 201)*. Torque-load the clamp securing nuts to 36-44 lbf.in. (Pre Mod.252180) or to 40-50 lbf.in. (Mod.252180)

(6) Make sure that the bonding jumper is in position on the boot-tube coupling connecting the turbine discharge duct to the unit turbine. Connect the coupling to the turbine using clamp. Torque-load clamp bolt nut to 25-30 lbf.in.

(7) Fit a serviceable seal and connect the air inlet duct to the unit heat exchanger using the duct clamp. Torque-load clamp securing nut to 40-50 lbf.in.

(8) Connect the flexible exhaust duct to the unit using the clamp. Torque-load the clamp bolt nut to 25-30 lbf.in. Make sure that there is a minimum clearance of 0.50 in. between the exhaust duct and the engine beam and control cables.

(9) Make sure the cooling turbine is filled with oil to the correct level (refer to Paragraph 1.A.)

**D. Checks/Tests after installation**

(1) Start an engine (Chapter 71, GENERAL) and set throttle to ground idle, or run the auxiliary power unit (Chapter 49, GENERAL).

(2) If an engine supply is being utilized, select the appropriate engine bleed MAIN AIR VALVE switch to OPEN, and check that the relevant MAIN AIR VALVE annunciator lights.

(3) Check, by feel of hand, for leaks at the refrigeration unit connections.

(4) Operate MAIN AIR VALVE switch to CLOSE, and check that the annunciator light goes out.

(5) Shut down engine (Chapter 71, GENERAL) or auxiliary power unit (Chapter 49, GENERAL).

## 3. Refrigeration Unit Cooling Turbine *(Figure 201)*

### A. Removal

(1) Remove refrigeration unit from the aircraft.

(2) Remove screws securing duct assembly; remove duct assembly and discard gasket.

(3) Remove bolts, clamps, compression spring and seal assembly connecting the refrigeration unit outlet duct to the turbine inlet duct.

(4) Remove the bolts which attach the turbine and bracket assembly; remove the turbine and bracket assembly, and discard packings.

### B. Installation

(1) Install new packing in groove on fan end of cooling turbine.

(2) Install new packing in groove around turbine mounting flange of plenum assembly.

(3) Position turbine in the heat exchanger assembly.

(4) Position bracket assembly on the turbine, insert washers between the bracket and turbine, with washers under the heads of the bolts, install and tighten the bolts. Wire-lock the bolts.

(5) Install the seal assembly, compression spring, clamps, bolts, washers and nuts which connect the refrigeration unit outlet duct to the turbine inlet duct. Make sure the washers are installed under the heads of the bolts and under the nuts.

(6) Position the new gasket in groove on the turbine outlet, and install the duct assembly using washers and screws.

(7) Install the refrigeration unit.

### C. Job close up

Remove all the tools, the materials and equipment. Make sure the work area is clean.

## WATER SEPARATOR - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch water separator 175050 consists of a condenser assembly inside an inlet shell and a collector inside an outlet shell.

The condenser assembly consists of a bypass valve, a conical condenser support, and a glass fibre condenser. Closely spaced vanes of the condenser support open toward the inside of the condenser support. The spring-loaded, normally closed bypass valve is mounted in the inlet end of the condenser support.

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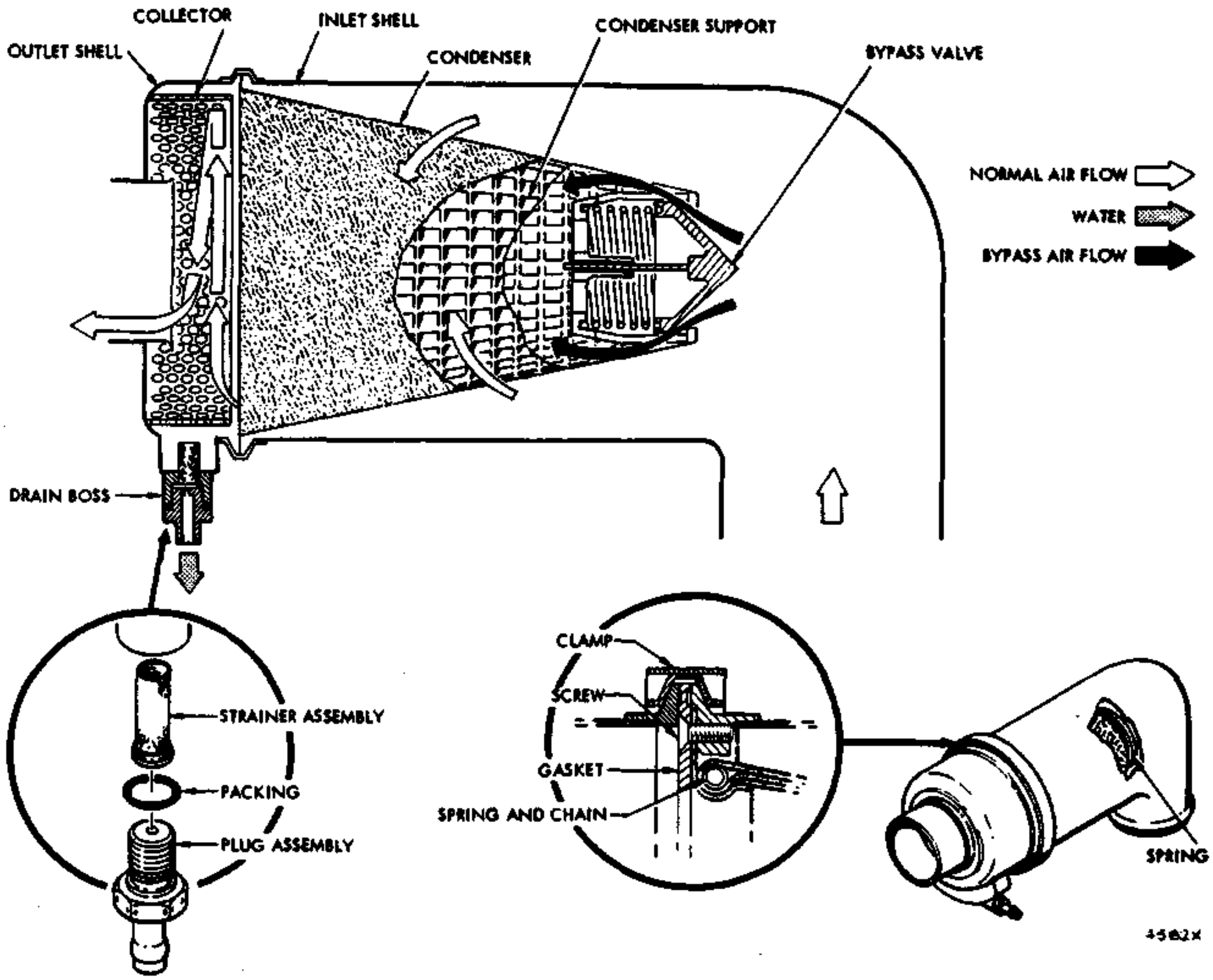


Water separator
Fig.1

...Water separator - Description and operation continued

The collector is a perforated cylindrical shell that divides the outlet shell into inner and outer chambers. An outlet duct on the outlet shell extends into the inner chamber. A drain boss is provided on the bottom of the outlet shell.

A drain plug assembly, packing, and strainer assembly are mounted within the drain boss to provide a means of draining condensed water from the separator.

## 2. Operation

The separator removes water particles from air by combining small water particles to increase the size of the particles, then separating the larger, heavier particles from the air by centrifugal force.

Small water particles in the air are formed into larger particles in flowing through the condenser. As the air passes through the vanes of the support, the water particles are carried with the swirling air and are thrown outward against the walls of the collector. The quiescent chamber between the collector and outlet shell permits the water entering the chamber to drain down the walls of the outlet shell to the bottom of the separator. The collected water then passes through the strainer assembly and is drained while the air is discharged through the air outlet of the separator.

If foreign material clogs the condenser, airflow through the separator is retarded and causes an increase in pressure differential across the bypass valve. When the pressure differential exceeds the force of the bypass valve spring, the valve opens and air passes through the valve without passing through the condenser. This bypassing of air ensures a constant flow of air to the cabin of the aircraft.

* * *

## WATER SEPARATOR - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| High cabin air humidity | Associated drainage equipment defective | Correct defect |
| | Plug assembly or strainer assembly clogged | Remove and clean plug assembly and strainer assembly. Install new packing. |
| | Condenser defective | Renew condenser |
| | Separator defective | Renew separator |
| Loss of cabin air pressure traced to separator | Gasket defective | Renew gasket |
| | Separator defective | Renew separator |
| Excessive noise from cabin air conditioning input system traced to separator | Separator by-pass valve damping unstable | Renew by-pass valve damper packings. |

* * *

# WATER SEPARATOR - MAINTENANCE PRACTICES

## 1. Removal/Installation (Fig.201)

### A. Remove separator

Equipment required :-

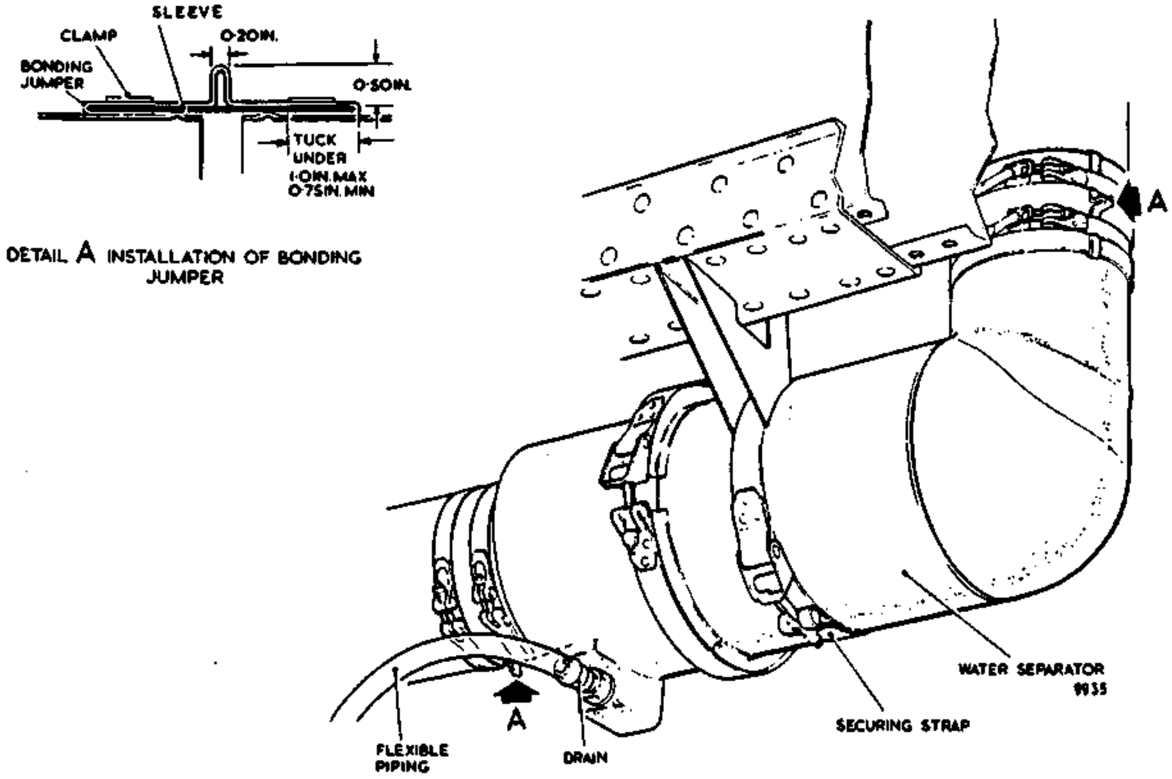
| | |
|---|---|
| Torque spanner .. .. .. | Capable of 25-75 lb.in. |

(1) Slacken hose clip and disconnect flexible pipeline from the separator drain connection.

(2) Slacken clamps and disconnect sleeves from the separator.

(3) Undo the strap securing the separator to its mounting, and remove the separator.

(4) Fit blanks to separator and open ducts.



Water separator installation
Fig.201

..Water separator - Maintenance practices continued

B. Install separator

(1) Remove blanks.

(2) With the bonding jumper in position,connect sleeve to the separator inlet using clamp. Ensure that sleeve is equalized over joint and that engagement with ducts is 1.3 in. minimum. Pre-Mod.252449: torque load clamp to 25 lb.in. (plus 5 lb.in., minus 0 lb.in.).

(3) Slacken clamp securing outlet shell, rotate outlet shell until drain is in lowest possible position with separator body horizontal, as shown on Fig.201. Tighten clamp and torque-load to 50 lb.in. ± 5 lb.in.

(4) With the bonding jumper in position, connect sleeve to the separator outlet using clamp.

(5) Fit dumbell tape to the separator securing strap, position strap around the separator and secure; torque-load strap to 50 lb.in. ± 5 lb.in.

(6) Connect flexible pipeline to the separator drain connection using hose clip.

C. Check/Tests after installation

(1) Start an engine (Chapter 71, GENERAL) and set throttle to ground idle, or run the Auxiliary Power Unit (APU) (Chapter 49, GENERAL).

(2) If engine supply is being utilized, select the appropriate engine MAIN AIR VALVE switch to OPEN, and check that the relevant MAIN AIR VALVE indicator shows OPEN.

(3) Check, by feel of hand, for leaks at the water separator connections.

(4) Operate MAIN AIR VALVE switch to CLOSE, and check that the indicator shows SHUT.

(5) Shut down engine (Chapter 71, GENERAL) or APU (Chapter 49, GENERAL).

D. Remove separator condenser and gasket (Fig.1)

(1) Remove the separator.

(2) Remove clamp and separate inlet shell from outlet shell.

(3) Remove screws and lift gasket and condenser assembly from inlet shell.

(4) Remove spring and chain, and remove condenser assembly from condenser support.

...Water separator - Maintenance practices continued

NOTE : The condenser is constructed of glass fibre and must be handled with care to prevent distortion taking place.

### E. Install separator condenser and gasket

(1) Feed spring and chain through pocket in large end of new condenser.

(2) Install condenser on condenser support and hook free end of chain on free end of spring.

(3) Install spring on small end of condenser so that it rests in recess in condenser support.

(4) Position condenser assembly in inlet shell and fit gasket and screws.

(5) Mate inlet shell to outlet shell and fit the securing clamp.

(6) Fit the seperator.

### F. Remove separator by-pass valve

(1) Remove the separator.

(2) Remove clamp and separate inlet shell from outlet shell.

(3) Remove screws and lift gasket and condenser assembly from inlet shell.

(4) Remove screws and washers securing by-pass valve to condenser assembly and remove valve.

### G. Install separator by-pass valve

(1) Position by-pass valve and secure using screws and washers, wire-lock screws.

(2) Position condenser assembly in inlet shell and fit gasket and screws.

(3) Mate inlet shell to outlet shell and fit securing clamp.

(4) Fit the separator.

## 2. Adjustment/Test

### A. Water separator leakage test

(1) Suitably blank off separator outlet and drain connection.

(2) Connect an oil-free air or nitrogen pressure source, complete with gauge and shut-off valve, to the separator inlet.

...Water separator - Maintenance practices continued

(3) Pressurize separator to 10 to 11 lb/sq.in.g. Close shut-off valve and check that the reading on the pressure gauge does not drop more than 1 lb/sq.in. in one minute.

(4) Release pressure, and disconnect pressure source.

(5) Remove blanks from separator outlet and drain connection.

(6) Check visually that the separator has not undergone any permanent deformation.

## 3.Approved repairs

### A.Renew separator by-pass valve damper packings (Fig. 202)

Materials required :

| | | |
|---|---|---|
| Packings (O-rings) (3) | .. | AN6227/6 (AiResearch) or MS 28775-11 |
| Oil .. | .. | DTD 585 or MIL-H-5606 |

(1) Remove by-pass valve (refer to para.1.F.).

(2) Dismantle separator by-pass valve :-

(a) Remove three screws securing packing retainer to valve assembly.

NOTE : Access to the screws retaining nuts is gained by compressing the valve springs towards the valve shut position.

(b) Slide the packings retainer from the valve shaft assembly.

(c) Carefully remove packings without damaging the packings retaining groove.

(3) Assemble separator by-pass valve :-

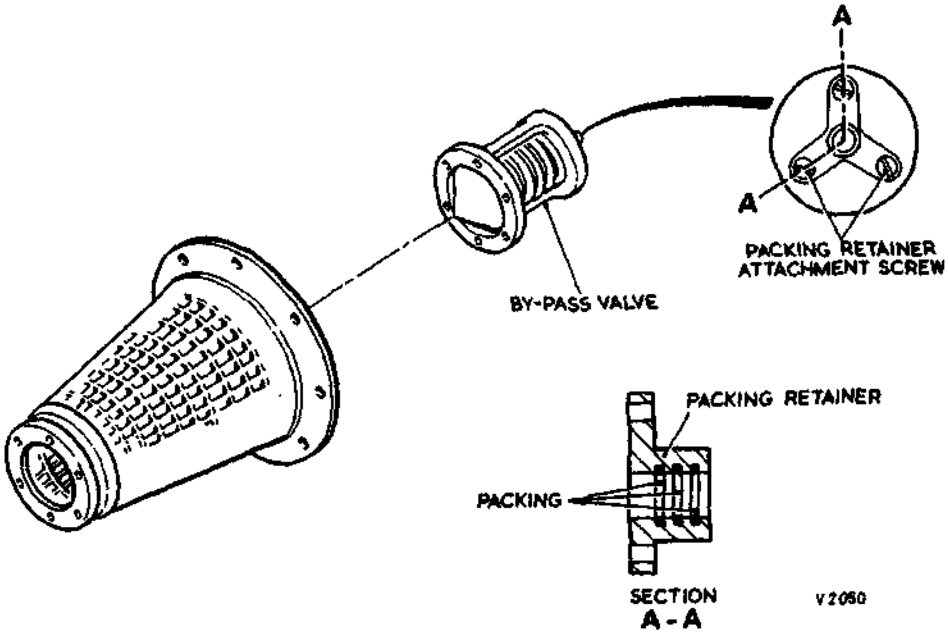
(a) Carefully insert new packings (see Parts required) into their retaining grooves ensuring that the groove edges are not damaged during packing insertion.

NOTE : A light smear of oil on the periphery of each packing will assist insertion.

(b) Slide retainer on to the valve shaft assembly and align securing screw holes. Fit screws, washers, self-locking nuts and tighten.

(4) Install the separator by-pass valve (see para.1.G.).

...Water separator - Maintenance practices continued



Water separator by-pass valve
Fig.202

* * *

# NON-RETURN VALVE (MAIN SUPPLY) - DESCRIPTION AND OPERATION

## 1. Description

The BAe (Dynamics Group) non-return valve type number AWE124-51, consists essentially of a valve body incorporating two valve apertures which are separated by a cross member to which two spring-loaded flap and arm assemblies are attached. The valve flaps each have an angular movement of approximately 90° and are secured to the flap arms which are carried on a spindle. The spindle is supported by two brackets fitted to the cross member. Two springs are located between the flap arms and these load the flaps in the closed position and provide a damping effect on the movement of the valve flap.

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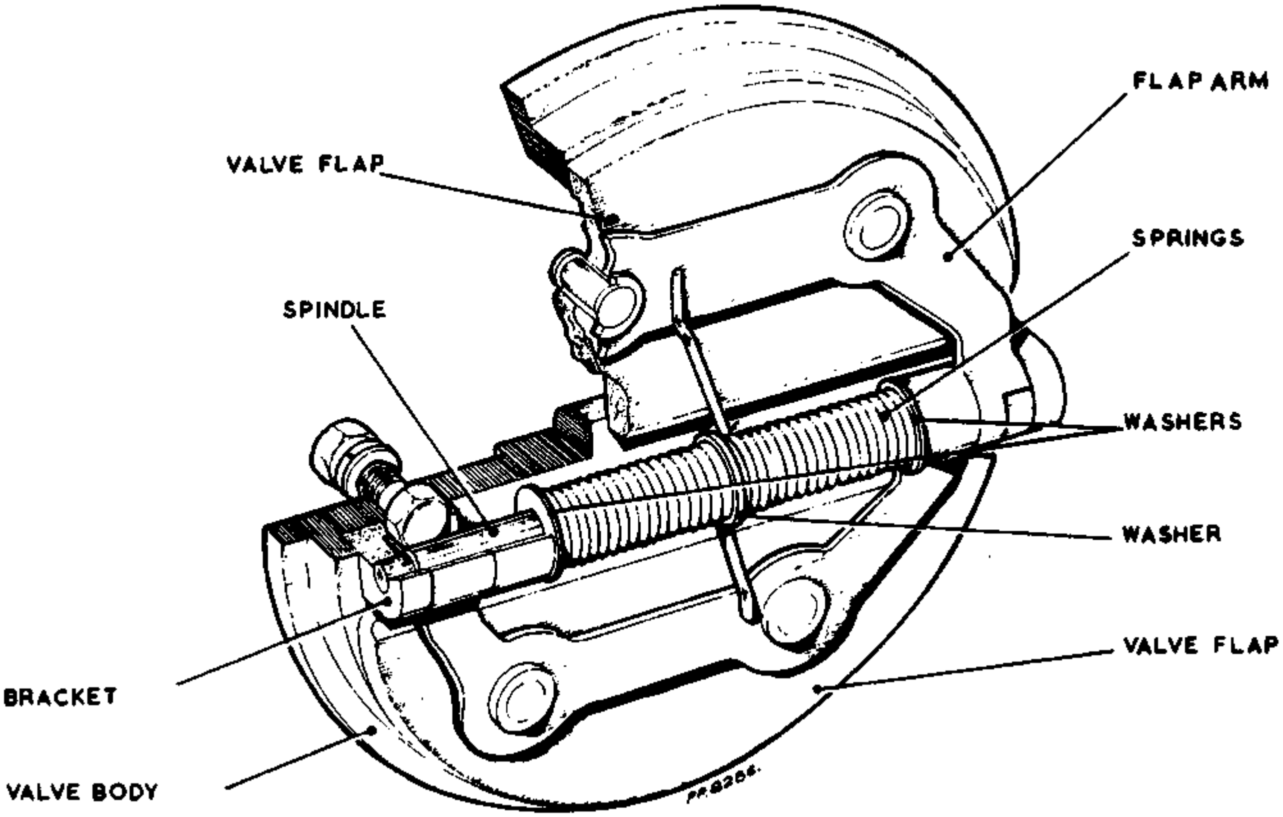

Non-return valve
Fig.1

## 2. Operation

The valve functions by opening to permit the supply of air when a small pressure differential exists, and to shut under spring action when differential pressure ceases, thus preventing airflow in the reverse direction.

* * *

# NON-RETURN VALVE (MAIN AIR SUPPLY) - MAINTENANCE PRACTICES

## 1. Procedure

| Equipment/Materials | Part/Item No. |
|---|---|
| Cleaning solvent (white spirit) | 219 (Chapter 20-95-201) |

### A. Removal

(1) Get access to the cabin side of the rear pressure bulkhead.

(2) Remove the two-way valve.

(3) At the rear of the pressure bulkhead, remove the bolts securing the coupling flange to the pressure-sealing cone.

(4) Remove the coupling flange from the sealing cone and remove the non-return valve.

(5) Blank-off the pressure sealing cone.

### B. Cleaning

**WARNING: DO NOT USE THE CLEANING FLUID NEAR FLAMES. USE THE CLEANING FLUID IN AN AREA WHICH HAS GOOD VENTILATION AND DO NOT BREATH THE FUMES.**

(1) Clean the valve with white spirit, Item 219.

(2) Use a lint-free cloth and make sure the valve is clean and dry.

### C. Inspection/check

(1) Make sure the valve has no visible damage.

(2) Make sure the valve is clean, especially between the flappers and the valve body.

(3) Make sure the valve components have no corrosion and the surface finish is good.

(4) Make sure the flappers have no distortion.

(5) Check that the flapper hinge pin and holes do not have excessive wear.

(6) Check that the flappers are securely riveted to the flap arms.

(7) Open the flappers against the springs and close them gently. Make sure the flappers are held closed with the spring and have good contact with the valve body.

**D. Installation**

(1) Remove blank from pressure sealing cone.

(2) Position the non-return valve so that the hinge axis is vertical. Insert the coupling flange into the pressure-sealing cone and secure with the bolts. Wire-lock the bolts.

(3) Install the two-way valve.

(4) Reinstall any equipment removed in paragraph A.(1).

**E. Functional test**

(1) Do a functional test of the air conditioning system (Chapter 21, PRESSURIZATION CONTROL).

**F. Job close up**

(1) Remove all the tools, the materials and the equipment. Make sure the work area is clean.

# FOOTWARMER AND WINDSHIELD DEMISTER VALVE - MAINTENANCE PRACTICES

## 1. Adjustment/Test

### A. Adjust valve

(1) Lower right-hand instrument panel (see Chapter 31, INSTRUMENT PANELS).

(2) Check for free movement by selecting intermediate position (knob pulled and rotated clockwise through $90^{o}$) and full FEET HEAT (knob pulled and rotated a further $90^{o}$).

(3) Adjust Bowden cable to take up any cable slack with valve at extreme of travel. Tighten locknut after adjustment.

(4) Turn knob anti-clockwise and release first to intermediate position and then to W/S DEMIST; checking that valve is returned by spring action.

NOTE : Pull knob slightly before turning, to release from bayonet slot.

(5) Raise and secure right-hand instrument panel (see Chapter 31, INSTRUMENT PANELS).

NOTE : A damper is fitted in the co-pilot's footwarmer duct to adjust (on the ground), the supply to the captain's feet. Adjust by slackening nut and bolt securing the lever to the gate, moving the lever as required, and tightening nut and bolt.

* * *

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# FOOTWARMER AND WINDSHIELD DEMISTER VALVE - MAINTENANCE PRACTICES

## 1. Adjustment/Test

### A. Adjust valve

(1) Select lever on the right-hand instrument panel to the FEET HEAT position.

(2) Release locknut on bracket-mounted Bowden cable adjuster located just forward and above the right-hand rudder pedals and aft of ducting.

(3) Turn adjuster to slacken cable, allowing the spring to pull the duct flap valve to the FEET HEAT position.

(4) Maintaining flap valve position, turn adjuster to take up cable slack. Tighten locknut.

(5) Check selector lever for full and free movement.

NOTE: A damper is fitted in the co-pilot's footwarmer duct so that adjustment can be made, on the ground, to vary the supply to the captain's feet. Adjustment is effected by slackening the nut and bolt securing the lever to the gate, moving the lever as required then tightening the nut and bolt.

* * *

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## VENTILATION FANS - MAINTENANCE PRACTICES

### 1. Removal/Installation

### A. Remove fan

(1) Remove instrument panel coaming (see Chapter 31, INSTRUMENT PANELS).

(2) On panel DA/D, trip COCKPIT AIR LH or RH circuit breaker (grid ref. E12 or E13) (see Chapter 24, GENERAL) and disconnect electrical connections to fan.

(3) Remove split pin, slacken clamping bolt on mounting bracket and rotate fan to disengage from punkah louvre air duct.

(4) Remove bolts securing mounting bracket to canopy rail and remove fan complete with bracket. Disengage fan from bracket.

### B. Install fan

(1) Position fan in mounting bracket but do not tighten clamping bolt at this stage.

(2) Ensure that grommets are in position in mounting bracket and are free from damage and deterioration. Replace packing washer under outboard lug of bracket. Secure mounting bracket to canopy rail with washers and bolts. The lugs of the capacitor clamp are located under outboard bolt head.

(3) Rotate fan to engage with punkah louvre air duct and, with the fan pushed into contact with the seal at the end of the windshield de-misting duct, tighten the clamp nut; lock nut with split pin.

(4) Make electrical connections to fan and reset circuit breaker.

(5) Install instrument panel coaming (see Chapter 31, INSTRUMENT PANELS).

(6) Energize d.c. busbars (see Chapter 24, GENERAL).

(7) Select CKPT FANS - ON, and check for correct operation. Select fans OFF.

(8) De-energize d.c. busbars (see Chapter 24, GENERAL).

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# PUNKAH LOUVRES - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove punkah louvre

(1) Remove instrument panel coaming (see Chapter 31, INSTRUMENT PANELS).

(2) Remove punkah louvre mounting bracket, disengage air duct from fan and remove punkah louvre complete with bracket and air duct.

(3) Remove countersunk bolts and separate clamping plate, air duct, mounting bracket and punkah louvre.

### B. Install punkah louvre

(1) Fit and secure countersunk bolts through mounting bracket, punkah louvre, air duct and clamping plate.

(2) Position mounting bracket on canopy rail and engage air duct with fan. Secure mounting bracket with nuts, washers and bolts. One of the bolts for the mounting bracket tightens into an anchor nut.

(3) Install instrument panel coaming (see Chapter 31, INSTRUMENT PANELS).

(4) Check louvre for free operation.

* * *

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## RAM AIR VALVE - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch electric shut-off butterfly valve 321262 consists of an electromechanical rotary actuator and a butterfly valve assembly. The actuator is mounted on the valve assembly.

The actuator contains an electric motor which is equipped with a magnetic brake, a gear train, limit switches and an output shaft. The splined end of the motor shaft extends into the gear case to actuate the gear train, output shaft, and limit switch actuating cams.

The valve assembly is made up of a valve body, which serves as an airflow duct and a butterfly assembly. The butterfly assembly consists of a butterfly clamped between two plates. One plate has an integral shaft section which engages the actuator output shaft. The other plate has an integral shaft section which supports the butterfly assembly and positions it within the body.

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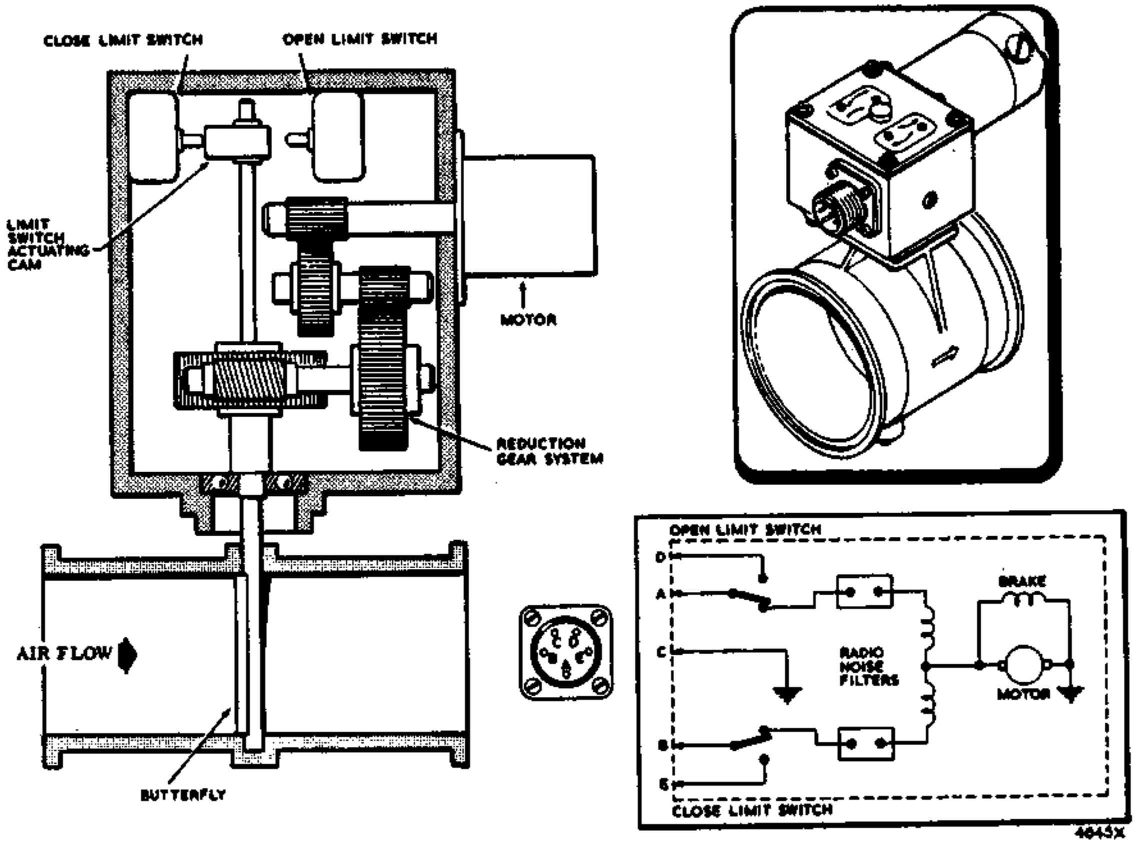

Ram air valve
Fig. 1

...Ram air valve - Description and operation continued

## 2. Operation

This unit is controlled by an external electrical circuit. When pins A and C are energized, the butterfly will move to full-open position. When pins B and C are energized, the butterfly will move to full-closed position. (See wiring diagram, Fig.1). When the butterfly is full-open or full-closed, the appropriate limit switch is mechanically tripped, opening the motor circuit and stopping actuator travel. When the butterfly is fully-open, circuit A-D is closed by the open limit switch; when the butterfly is fully closed, circuit B-E is closed. These circuits can be utilized to operate remote equipment. The limit switches are adjustable so that the butterfly travel may be limited in either direction.

Should the motor circuit be de-energized before one of the limit switches is tripped, the magnetic brake, in conjunction with the gear train, will hold the butterfly at the selected position.

## 3. Data

| | |
|---|---|
| Operating Air Pressure | 81 PSIG (Max) |
| Operating Air Temperature | 93°C (200°F) (Max) |
| Operating Time | 7 to 13 Sec at 4.4° to 49°C (40° to 120°F) |
| Ambient Air Temperature Range | -54° to 107°C (-65° to 225°F) |
| Actuator | |
| Receptacle | AN3102A-145-5P |
| Pin A | Energize to open butterfly |
| Pin B | Energize to close butterfly |
| Pin C | Earth |
| Pin D | Energized when butterfly is fully open |
| Pin E | Energized when butterfly is fully closed |
| Operating Current | 1.2 Amp at 26V DC (Max) at 4.4° to 49°C (40° to 120°F) |
| Duty Cycle | Operating Time<br>15 Sec on - 45 Sec off with ambient Temp. of - 54° to 65°C (-65° to 150°F) 15 Sec on.<br>2 Min off with ambient Temp. of 65° to 107°C (150° to 225°F) |

* * *

## RAM AIR VALVE - TROUBLE SHOOTING

| Fault | Probable cause | Remedy |
|---|---|---|
| Leakage at ducting connection | Connections loose or defective | Tighten connections or renew defective component |
| Erratic or sluggish operation | Electrical connection loose or defective<br>Butterfly binding | Tighten connection or renew defective component<br>Renew unit |
| Unit operates in only one direction | Actuator defective | Renew unit |
| Unit inoperative | Electrical connection loose or defective<br>Actuator defective<br>Butterfly bound in housing | Tighten connection or renew defective component<br>Renew unit<br>Renew unit |

* * *

## RAM AIR VALVE - MAINTENANCE PRACTICES

1. Removal/Installation

A. Remove valve

(1) On panel DA/D, trip circuit breaker RAM AIR VALVE (grid ref.E5) (see Chapter 24, GENERAL).

(2) Disconnect electrical cable socket-plug from the valve.

(3) Undo clamps securing valve to stub pipe bracket assemblies; remove valve and seals.

(4) Fit blanks to valve, and stub pipe bracket assemblies.

B. Install valve

(1) Remove blanks.

(2) Position valve so that arrow on valve body indicates direction of airflow, fit serviceable seals, and secure valve to stub pipe bracket assemblies using clamps; torque-load clamp-bolt nuts to 50-60 lb in. (pre Mod.252180) or to 40-50 lb in. (Mod.252180).

(3) Connect socket-plug to valve socket.

(4) Reset circuit breaker.

C. Checks/Tests after installation

(1) Energize d.c. busbars (see Chapter 24, GENERAL).

(2) CAUTION : DUE TO THE DANGER OF OVERHEATING, VALVE OPERATION MUST BE LIMITED TO A MAXIMUM DURATION OF 15 SECONDS FOLLOWED BY A REST PERIOD OF 45 SECONDS (AMBIENT TEMPERATURE NOT EXCEEDING 150°F, 65°C) OR 2 MINUTES (AMBIENT TEMPERATURE EXCEEDING 150°F).

Operate RAM AIR switch to ON, and check that the valve motors to the fully open position in 7 to 13 seconds.

(3) Operate RAM AIR switch to OFF, and check that the valve motors to the fully closed position in 7 to 13 seconds.

(4) De-energize d.c. busbars.

* * *

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# CHECK VALVE (RAM AIR SUPPLY) - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch check valve 123190 consists essentially of a valve body containing two semi-circular flappers hinged about a pin running through the centre of the valve body. The valve is located normal to the airflow axis in a circular air duct.

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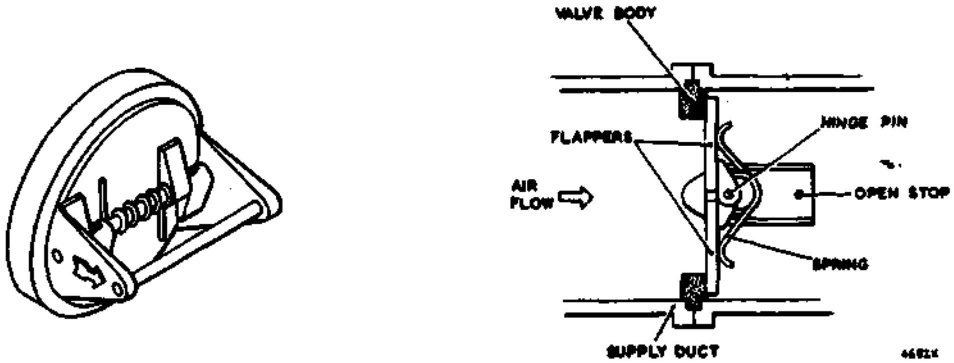

Check valve
Fig.1

## 2. Operation

Air pressure on the upstream side of the check valve acts upon the surface of the flappers. The flappers move toward open position allowing normal airflow.

If the airflow is reversed, the flappers close. Airflow is halted until the upstream-to-downstream air pressure differential is sufficient to re-open the flappers.

## 3. Data

| | |
|---|---|
| Operating air pressure (normal flow) ... ... | 20 lb/sq.in.g.(max.) |
| Operating air pressure (reverse flow) ... ... | 9 lb/sq.in.g.(max.) |
| Operating air temperature ... ... ... | 204°C (400°F) (max.)<br>STD Air density. |

* * *

## CHECK VALVE (RAM AIR SUPPLY) - TROUBLE SHOOTING

| Fault | Probable cause | Remedy |
|---|---|---|
| Airflow erratic | Flappers binding, hinge pin distorted. | Renew valve |
| | External leakage of valve | Renew duct O-ring |
| | Loose or defective duct connections | Tighten connections or renew defective components |
| Valve fails to check | Obstruction in air duct | Remove obstruction |
| | Flapper or pin damaged | Renew valve |

* * *

# CHECK VALVE (RAM AIR SUPPLY) - MAINTENANCE PRACTICES

## 1. Procedure

| Equipment/Materials | Part/Item No. |
|---|---|
| Cleaning solvent (white spirit) | 219 (Chapter 20-95-201) |

### A. Removal

(1) Get access to the cabin side of the rear pressure bulkhead.

(2) Slacken hose clip and disconnect flexible pipeline from the ram air coupling at the pressure dome.

(3) With an operator positioned at the rear of the pressure bulkhead to retain the nuts and washers, remove bolts securing the ram air coupling. Remove coupling, valve retainer, non-return valve and gasket.

(4) Install blanks to the flexible pipeline and the open duct.

### B. Cleaning

**WARNING: DO NOT USE THE CLEANING FLUID NEAR FLAMES. USE THE CLEANING FLUID IN AN AREA WHICH HAS GOOD VENTILATION AND DO NOT BREATH THE FUMES.**

(1) Clean the valve with white spirit, Item 219

(2) Use a lint-free cloth and make sure the valve is clean and dry.

### C. Inspection/check

(1) Make sure the valve has no visible damage.

(2) Make sure the valve is clean, especially between the flappers and the valve body.

(3) Make sure the valve components have no corrosion and the surface finish is good.

(4) Make sure the flappers have no distortion.

(5) Check that the flapper hinge pin and holes do not have excessive wear. Check that axial and radial play is not more than 0.025 in.

(6) Open the flappers against the spring and close them gently. Make sure the flappers are held closed with the spring and have good contact with the valve body.

### D. Installation

(1) Remove blanks

(2) Position gasket, non-return valve, valve retainer and the ram air coupling on the pressure bulkhead. Insert the securing bolts through the assembly, pressure bulkhead, elbow assembly and the equipment bay ventilation stub (bottom three bolts only), and secure using washers and nuts.

(3) Install flexible pipeline to the ram air coupling and secure with the hose clip.

(4) Reinstall any equipment removed in paragraph A.(1).

### E. Functional test

(1) Do a functional test of the air conditioning system (Chapter 21, PRESSURIZATION CONTROL).

### F. Job close up

(1) Remove all the tools, the materials and the equipment. Make sure the work area is clean.

## SHUT-OFF VALVE (APU SUPPLY) - MAINTENANCE PRACTICES

NOTE : For description of this valve, see 21-10-25.

### 1. Removal/Installation

#### A. Remove valve

(1) On panel DA/C, trip circuit breaker APU AIR VALVE (grid ref.H3) (see Chapter 24, GENERAL).

(2) Disconnect electrical cable socket-plug from the valve socket.

(3) Undo clamps securing valve to venturi and bellows assembly; remove valve and seals.

(4) Fit blanks to valve, venturi and bellows assembly.

#### B. Install valve

(1) Remove blanks from valve, venturi and bellows assembly.

(2) Position valve so that the arrow on the valve body indicates direction of airflow, fit serviceable seals, and secure valve to venturi and bellows assembly using clamps. Torque load clamp bolt nuts to 70-80 lb in. (pre Mod.252180) or to 40-50 lb in. (Mod.252180) at the connection to the venturi only, and to 45-55 lb in. (pre Mod.252180) or to 40-50 lb in. (Mod.252180) at the connection to the bellows assembly.

(3) Connect socket-plug to the valve socket.

(4) Reset circuit breaker.

#### C. Checks/Tests after installation

(1) Start auxiliary power unit (see Chapter 49, GENERAL).

(2) CAUTION : DUE TO THE DANGER OF OVERHEATING, VALVE OPERATION MUST BE LIMITED TO A MAXIMUM DURATION OF ONE MINUTE FOLLOWED BY A REST PERIOD OF FOUR MINUTES.

Select APU AIR switch to ON, and check that the valve motors to the fully open position in 10 to 14 seconds.

(3) Check valve joints, by feel of hand, for leaks.

(4) Select APU AIR switch to OFF, and check that the valve motors to the fully closed position.

(5) Shut down auxiliary power unit (see Chapter 49, GENERAL).

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## PRESSURIZATION CONTROL - DESCRIPTION AND OPERATION

### 1. Description (Figs.1 & 2)

Cabin pressurization is achieved by feeding in a constant supply of air from the engines and controlling the outflow to obtain the required pressure in the cabin.

Cabin pressure is controlled by two outflow/safety valves, one is situated at the bottom left of the cabin rear pressure bulkhead, and the other is situated at the top right of the pressure bulkhead. Both valves are calibrated for a cabin differential pressure setting of 8.35 + 0.20 lb/sq.in. The valves are automatically controlled in the same manner during normal system operation, but to cater for malfunctioning of the system one valve can be manually controlled. Each valve operates basically on a pressure differential between cabin pressure and reference pressure sensed from the outflow/safety valve controller, via a pneumatic relay.

The outflow/safety valve controller, situated on the right instrument panel has two controls, one on the right of the unit for selection of the desired cabin altitude and the other on the left of the unit for selection of the desired cabin rate of change. The outflow/safety valve controller ensures that the outflow/safety valves maintain a selected cabin altitude, also that cabin air pressure changes at an acceptable rate whenever different altitudes are selected, or during climb or descent.

Two identical pneumatic relays, situated on the cabin rear pressure bulkhead, sense cabin pressure changes as referenced by the outflow/safety valve controller; their purpose is to relay these changes to the outflow/safety valves so eliminating any delay in their response.

An air jet pump, situated on the cabin rear pressure bulkhead and connected into the ambient bleed line from the pneumatic relays, ensures that there is a positive airflow from the outflow/safety valves reference chambers to ambient via the pneumatic relays; this ensures that the desired differential between the outflow/safety valves reference and cabin pressure chambers is maintained. The jet pump is operated by engine bleed air tapped from the duct downstream of the mixing valves.

### A. Safety control

As a safety device, pressure regulators, set to maintain cabin altitude at 13500 ± 1500 ft. in the event of system malfunction, are installed adjacent to each outflow/safety valve. They connect into the outflow/safety valves reference chamber bleed lines and are open to cabin pressure. When the cabin altitude exceeds the calibrated setting of the pressure regulator it operates to feed cabin air into the reference chamber bleed line. The introduction of cabin pressure air into the overflow/safety valve reference chamber equalises the air pressure across the diaphragm, allowing the spring to close the outflow/safety valve.

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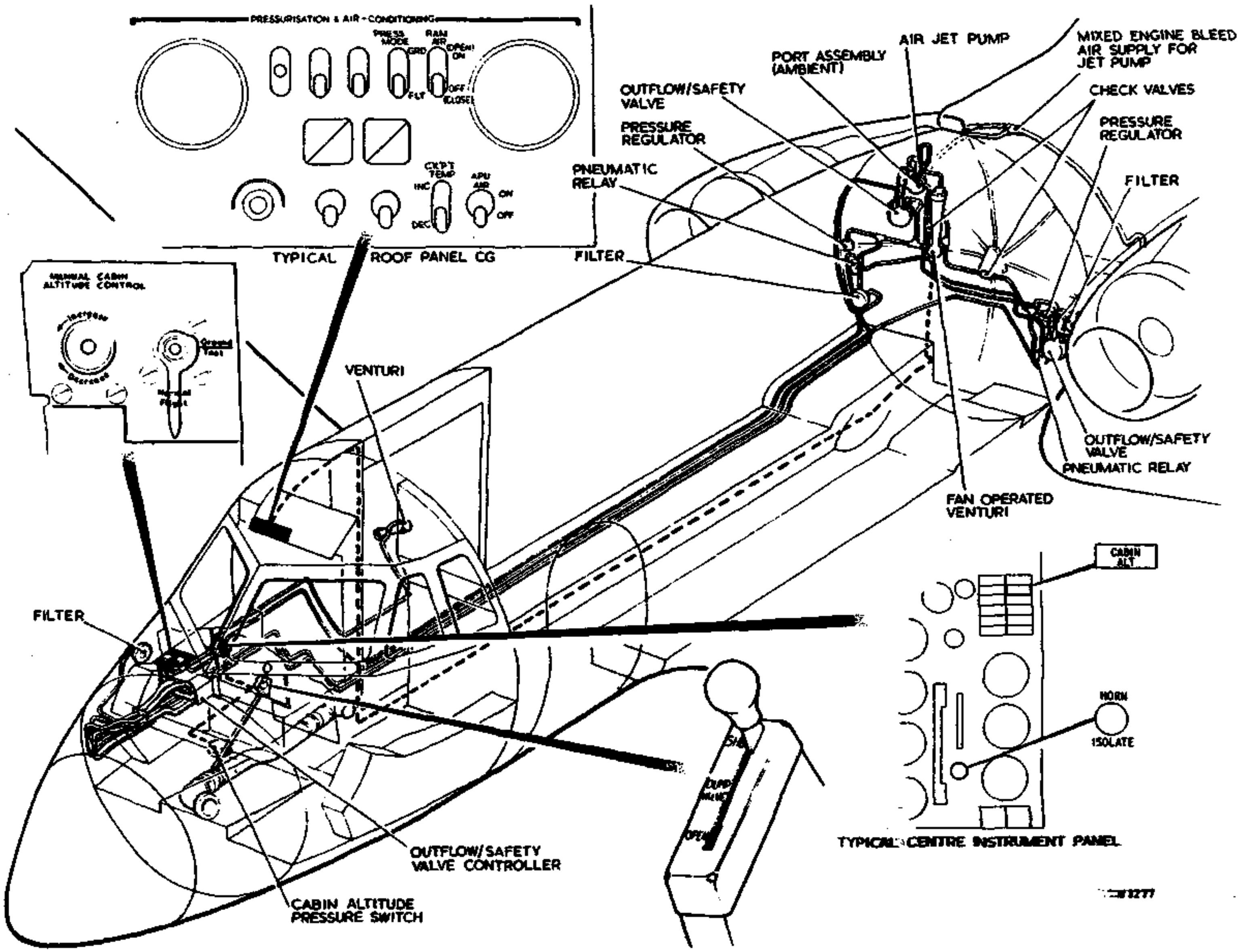

Pressurization control system
Fig.1

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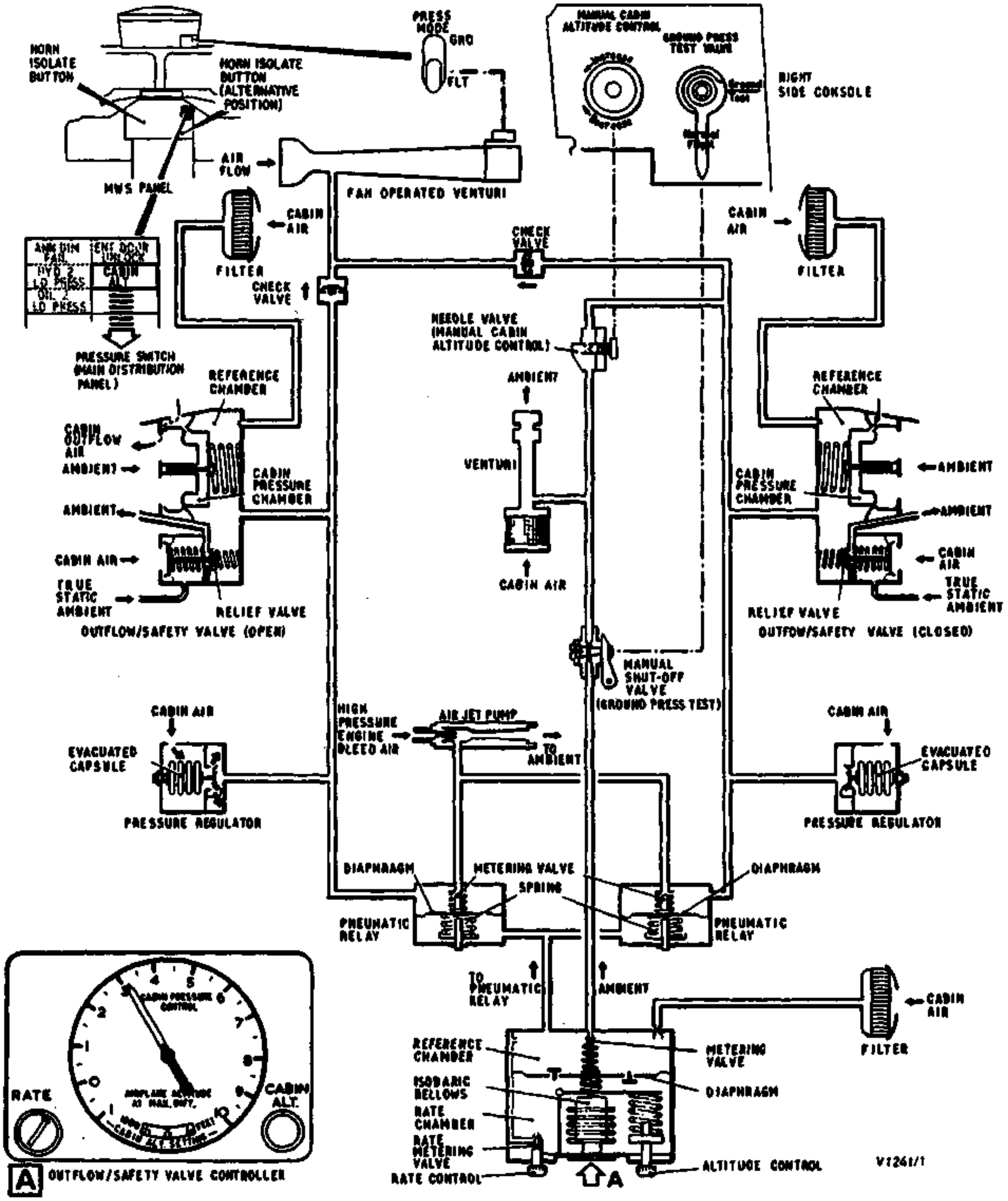

Pressurization control - schematic diagram
Fig.2

...Pressurization control - Description and operation continued

B. Ground air conditioning

A fan operated venturi, situated on the cabin rear pressure bulkhead, is provided to create a pressure differential between the reference and pressure chambers of the outflow/safety valves, by reducing pressure in the reference chamber, so that the valves will open to permit the escape of cabin air from the cabin during ground air conditioning. The venturi is controlled, via the landing gear lever lock circuit, by a switch labelled PRESS MODE with selections FLT-GRD situated on the PRESSN & AIR CONDITIONING section of the main roof switch panel. Two check valves isolate the venturi when it is not in use.

C. Manual control

Two manually operated valves are provided in the system, both situated on the right console. One is a shut-off valve labelled GROUND PRESS TEST VALVE with selections to NORMAL FLIGHT and GROUND TEST, the other is a needle valve labelled MANUAL CABIN ALTITUDE CONTROL with selections INCREASE and DECREASE. Both valves are used in conjunction with each other to provide manual control of the system in the event of system malfunction. The GROUND PRESS TEST VALVE is connected into the ambient bleed line from the outflow/safety valve controller and, when selected to GROUND TEST shuts off the ambient bleed. The subsequent pressure increase within the controller is sensed by the reference chambers of the outflow/safety valves, with the result that the valves will close and become inoperative. The MANUAL CABIN ALTITUDE CONTROL valve, when open, connects the reference chamber of the outflow/safety valve situated at the top right of the cabin rear pressure bulkhead to ambient via a venturi. This valve can therefore, by control of the pressure differential between the outflow/safety valve reference and pressure chambers, assume complete control of valve operation, and so maintain the desired cabin altitude and rate of pressure change.

D. Indication

Cabin air pressure conditions are monitored by a cabin rate of climb indicator, cabin altimeter and a cabin differential pressure indicator, all located on the pilots' instrument panel.

A pressure switch, situated on the front pressure bulkhead immediately forward of the first pilot, will operate if the cabin altitude rises to 9300 ft to bring on a warning annunciator CABIN ALT and situated on the pilots' centre instrument panel, and sound a warning horn situated to the rear of the first pilot. The horn can be cancelled by pressing a HORN ISOLATE button on the centre instrument panel.

E. Inward relief

To protect against a negative cabin differential, the outflow/safety valves each incorporate an inward relief facility. If ambient pressure exceeds cabin pressure beyond calibrated limits, the valves will operate to permit ambient pressure to flow into the cabin. Under this condition the cabin altitude will change at aircraft rates, irrespective of control settings.

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### F. Cabin pressure relief

If the cabin pressure differential exceeds the calibrated limits, pressure in the cabin must be reduced. To achieve this, pressure relief valves are incorporated in the outflow/safety valves. When cabin pressure exceeds the relief valve setting, the valve will operate and permit air in the outflow/safety valve reference chamber to exhaust to ambient; the resulting pressure differential between the reference and cabin pressure chambers is sufficient to open the valve and reduce cabin pressure. Under this condition normal system control is inoperative.

### G. Cabin dump

A lever controlled, friction-loaded butterfly valve provides a means of controlling cabin differential pressure and rates of change if normal methods of system control are inoperative; also it ensures, when fully open, that there is no pressure differential on the aircraft. The valve, which discharges air into the nose gear bay, is controlled from a lever located on the right-hand side of the radio console; the lever is operated between OPEN and SHUT to control valve position.

## 2. Operation (Fig.2)

### A. Normal

With air conditioning in use a constant supply of air is fed into the cabin. Filtered air enters the outflow/safety valve controller reference chamber, and the outflow/safety valves pressure and reference chambers.

The normal function of both outflow/safety valves is identical so during the following description only one valve will be referred to.

Selection of an altitude above station altitude on the outflow/safety controller compresses the isobaric bellows within the unit to open the metering valve.

Cabin pressure entering the controller reference chamber passes through the metering valve to ambient; pressure within the chamber is also felt on the spring side of the pneumatic relay diaphragm. Pressure in the reference chamber of the outflow/safety valve is felt on the other side of the relay diaphragm and, when the pressure differential between the two sides of the diaphragm is sufficient to compress the spring, the relay metering valve will lift off its seat and permit outflow/safety valve reference chamber pressure to pass to ambient.

Outflow/safety valve reference pressure now escapes at a faster rate than it enters the chamber, this brings about a pressure differential between the reference and pressure chambers sufficient to cause the valve to open and maintain an essentially unpressurized cabin, providing aircraft rate of climb does not exceed the selected rate of pressure change.

As the cabin pressure enters the isobaric operating range the isobaric bellows, within the outflow/safety valve controller, expands and positions the unit metering valve to meter flow of reference chamber air to ambient. This produces an essentially constant pressure in the reference chamber which is felt in the pneumatic relay. Constant pressure in the spring side of the relay diaphragm ensures that the outflow/safety valve reference chamber pressure on the other side of the diaphragm also remains constant. Under this condition variations in cabin pressure felt in the outflow/safety valve pressure chamber bring about changes in the pressure differential between the reference and pressure chambers, causing the valve to open or shut in order to maintain the cabin pressure at the selected cabin altitude.

If the aircraft rate of climb exceeds the selected rate of change, the outflow/safety valve controller reference chamber pressure decreases, causing, due to the rate metering valve restricting the passage of air from the rate chamber to the reference chamber, a pressure differential between these chambers sufficient to flex the valve diaphragm and move the reference chamber metering valve to restrict the flow of air to ambient. Pressure in the reference chamber will now change at the selected rate, causing the outflow/safety valve to control the rate of change of cabin pressure in accordance with that selected.

B. Manual

With the PRESS TEST VALVE selected to the GROUND TEST position the ambient bleed from the outflow/safety valve controller is shut off. Cabin pressure entering the controller reference chamber cannot now bleed to ambient, causing a pressure build up within the chamber; this will also be felt on the spring side of the pneumatic relay diaphragm which will flex to close the metering valve and prevent the outflow/safety valve reference chamber air escaping to ambient. The air pressure in the safety/outflow reference and pressure chambers equalise, allowing the spring in the reference chamber to close the valve.

The outflow/safety valve situated at the top right of the cabin rear pressure bulkhead can now be controlled to give the desired cabin pressure and rate of change. With the MANUAL ALTITUDE CONTROL selected to INCREASE or DECREASE, the outflow/safety valve reference chamber pressure is allowed to escape to ambient.

This provides control of the pressure differential between the valve reference and pressure chambers and the subsequent control of valve operation, enabling the desired cabin pressure and rate of change to be maintained.

* * *

## PRESSURIZATION CONTROL - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Ground pressure testing

Precautions

Before effecting a test which involves pressurizing, the following precautions and recommendations are to be observed.

(1) Ensure that the aircraft structure is complete and fit for flight.

(2) Ensure that the static and pitot pipelines, in the pressurized area, are complete and connected to their relevant unit. If this is not possible the unit must be removed and the pipelines blanked.

(3) Ensure that all doors, hatches and windows in the pressurized area are fully closed.

(4) It is recommended that personnel taking part in the pressure tests within the pressurized fuselage are certified medically fit within the test requirements; this includes freedom from colds and sinus trouble.

(5) A minimum of two operators must be inside the fuselage during a pressure test using an external rig as the supply source. When using engines as the supply source a third operator, to run the engines, is required.

(6) When using an external rig as the supply source, intercommunication must be established between personnel inside and outside the fuselage.

Pressurizing procedures

(1) The fuselage can be pressurized by an external rig connected to the ground pressurization point on the fuselage under-surface, from the engines, or from the auxiliary power unit. Except for the external rig the complete air conditioning system must be serviceable.

(2) Up to a pressure differential of 8 lb/sq.in. the rate of change of cabin altitude must not exceed 2000 ft/min. Above 8 lb/sq.in. the rate of change must not exceed 1000 ft/min. The rate of change is indicated on the cabin rate of climb indicator.

(3) When de-pressurizing, the rate of change must not exceed 2000 ft/min.

WARNING : SHOULD THE LEAK RATE INCREASE UNDULY DURING ANY PRESSURE TEST, AS INDICATED BY A SUDDEN CHANGE IN THE READING ON THE CABIN RATE OF CLIMB INDICATOR, THE PRESSURE MUST BE RELEASED AND THE FUSELAGE INSPECTED FOR DAMAGE BEFORE THE TEST IS CONTINUED.

(4) The differential pressure across the structure must not exceed 8.75 lb/sq.in.

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...Pressurization control - Maintenance practices continued

Instrumentation

(1) When pressure tests are effected using an external source, connect the following instruments to one of the unions of the ground pressurization adapter :

(a) Rate of climb indicator, 0 to 2000 ft/min.
(b) Manometer and/or pressure indicator, 0 to 15 lb/sq.in.

NOTE : The other test union is provided for duplicate instrumentation which must be fitted during a pressure test in which safety valves are removed or inoperative.

(2) The calibration of all instruments used in pressure testing must be accurately checked.

(3) A vibrator should be fitted to the instrument panel to prevent the instruments sticking, alternatively gently tap the instruments.

B. Functionally test pressurization system

NOTE : During the following system test it is necessary to have an engine running to effect operation of the system air jet pump. Pressurization air may, however, be supplied by the following alternative sources :

(a) An air supply rig connected to the ground test connection.
(b) The auxiliary power unit, if fitted (see Chapter 49).

(1) Observe instructions contained in para.1.A.

(2) Ensure cabin dump valve is SHUT.

(3) Ensure that the fan venturi PRESS MODE switch is at FLT.

(4) Run the engines at ground idle (see Chapter 71, GENERAL).

(5) Select No.1 or 2 INV switch to START.

NOTE: (a) Operation (6) is applicable only if engine supply air is being utilized for the pressure test.
(b) Operations (7) and (8) are not applicable if air for the pressure test is being supplied via the ground test connection.

(6) Select MAIN AIR VALVES switches to OPEN and check that the MAIN AIR VALVE indicators show OPEN, or if APU is used, selct APU AIR switch to OPEN.

(7) Select cabin temperature control AUTO/MANUAL switch to AUTO.

...Pressurization control - Maintenance practices continued

(8) Select cabin temp selector, as required.

(9) Set the outflow/safety valve controller altitude selector knob to -1000 feet.

(10) During pressurization operate the outflow/safety valve controller rate control knob between MAX and MIN and check that the rates as indicated on the cabin rate of climb indicator change progressively between 2000 and 50 ft/min.

(11) Operate GROUND PRESS TEST VALVE selector to GROUND TEST position.

(12) Increase the differential pressure to 8 lb/sq.in. at a rate of change not exceeding 2000 ft/min, effecting control by operation of the MANUAL CABIN ALTITUDE CONTROL selector.

(13) Maintaining control as in operation (12), increase the differential pressure up to 8.55 lb/sq.in. at a rate of change not exceeding 1000 ft/min, and check that one or both of the outflow/safety valves operate.

(14) Reduce the cabin differential pressure by slowly opening the dump valve.

NOTE : Operations (15) to (20) need to be carried out only if one of the outflow/safety valves failed to operate during operation (13).

(15) Blank off the atmosphere connection of the outflow/safety valve pressure relief valve which operated during operation (13).

(16) Close the dump valve.

(17) Increase the differential pressure to 8 lb/sq.in. at a rate of change not exceeding 2000 ft/min, effecting control by operation of the MANUAL CABIN ALTITUDE CONTROL selector.

(18) Maintaining control as in operation (17), increase the differential pressure up to 8.55 lb/sq.in. at a rate of change not exceeding 1000 ft/min, and check that the unblanked outflow/safety valve operates.

(19) Reduce differential pressure by slowly opening the dump valve.

(20) Remove blank and re-make atmosphere connection to outflow/safety valve pressure relief valve.

(21) Set the outflow/safety controller altitude selector knob to 2000 feet. above airfield altitude.

(22) Close the dump valve, operate the MANUAL CABIN ALTITUDE CONTROL to the full DECREASE (closed) position, and select the GROUND PRESS TEST VALVE selector to the NORMAL FLIGHT position.

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(23) During de-pressurization operate the outflow/safety valve controller rate control knob between MAX and MIN and check that the rates change progressively between 2000 and 50 ft/min.

(24) Select cabin temp selector to COOL.

(25) Select both MAIN AIR VALVES switches to CLOSE and check that MAIN AIR VALVE indicators show SHUT or if APU is used, select APU AIR switch to CLOSE.

(26) Select INV switch to STOP.

(27) Shut down engines (see Chapter 71, GENERAL) and, if applicable, shut down the auxiliary power unit (see Chapter 49) or disconnect air supplies. If applicable, refit ground test connections blanks and wire-lock.

(28) Open dump valve to ensure that all cabin pressure is dissipated. Close dump valve.

C. Test cabin leak rate

NOTE : This test is to ensure that the cabin leak rate is within the specified limit.

(1) Observe instructions contained in para. 1.A.

(2) Blank off venturi located forward of cabin windows on right-hand side.

(3) Ensure that the cabin dump valve is OPEN.

(4) Ensure that the fan venturi PRESS MODE switch is selected to FLT.

(5) Operate GROUND PRESS TEST VALVE selector to the GROUND TEST position.

(6) Operate the MANUAL CABIN ALTITUDE CONTROL selector to the fully DECREASE position.

(7) Introduce the air supply, to pressurize the fuselage, by one of the following :

(a) An air supply rig connected to the ground test connection.
(b) Run the engines (see Chapter 71, GENERAL), observing rate of change limitations detailed in operation (9).
(c) Run the auxiliary power unit, if fitted (see Chapter 49, GENERAL).

(8) If engine supply air is being utilized, select both MAIN AIR VALVES switches to OPEN. Check that the MAIN AIR VALVE indicators show OPEN. Select the cabin temperature control AUTO/MANUAL switch to AUTO and temperature as required.

...Pressurization control - Maintenance practices continued

(9) Progressively close cabin dump valve and allow differential pressure to rise to a figure above 4 lb/sq.in. at a rate of change not exceeding 2000 ft/min., and shut off air supply.

(10) Allow pressure to drop by normal leakage and check that the time taken for the pressure to fall from 4 lb/sq.in. to 3 lb/sq.in. is not less than 27 seconds.

(11) Depressurize the fuselage by slowly opening the dump valve; the rate of change is not to exceed 2000 ft/min.

(12) Shut down engines (see Chapter 71, GENERAL) or auxiliary power unit (see Chapter 49, GENERAL) or disconnect air supply. If applicable, refit ground test connection blank and wire-lock.

(13) Remove blank from the venturi.

(14) Close dump valve.

(15) Operate GROUND PRESS TEST VALVE selector to the NORMAL FLIGHT position.

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## OUTFLOW/SAFETY VALVE CONTROLLER - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch cabin air pressure outflow valve control 102464 comprises two separate pressure controlling systems; variable isobaric and selective pressure rate of change.

The variable isobaric control system consists of an evacuated isobaric bellows and rocker arm, which are connected to an isobaric metering valve through a rate control spring. An isobaric calibration spring and isobaric calibration screw are secured to the rocker arm, and are indexed to a cabin altitude pointer through a gear train.

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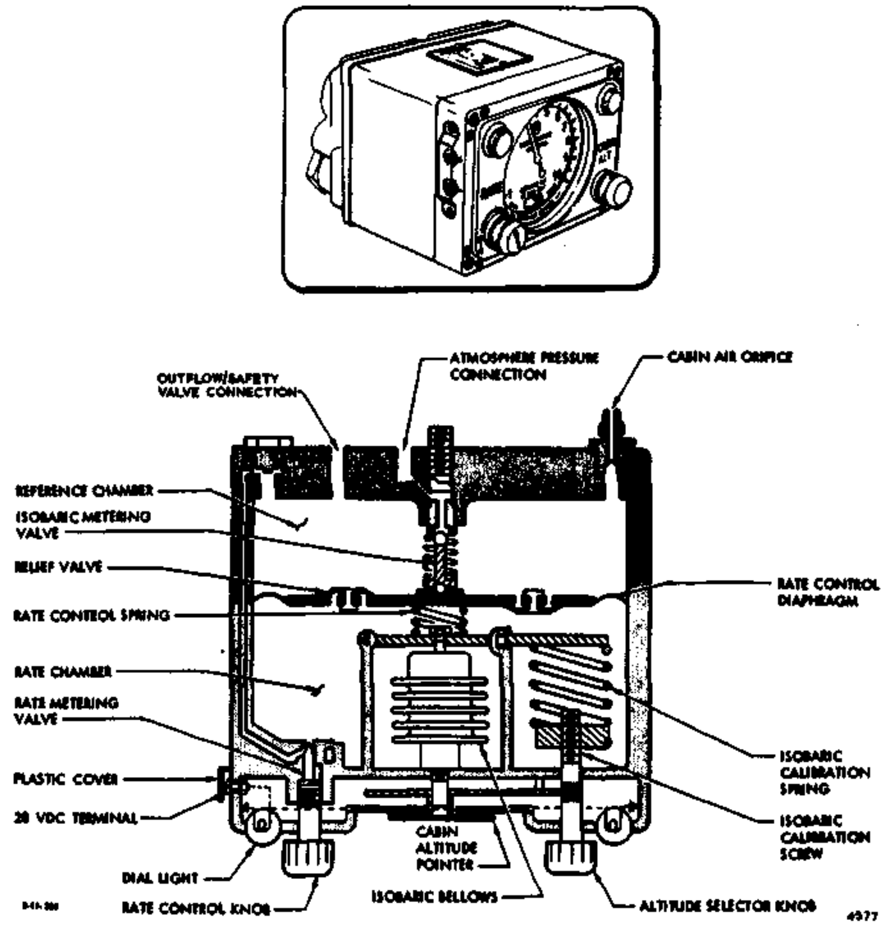

Outflow/safety valve controller

Fig.1.

...Outflow/safety valve controller - Description and operation continued

The selective pressure rate-of-change system consists of the rate control spring, a rate control diaphragm with two relief valves which separates the housing into two chambers, a drilled passage connecting the two chambers, a rate metering valve, and a valve seat.

Two dial lights are located in the upper corners for illumination of the face of the control. Electrical connections, protected by a plastic cover, are located on the side of the housing.

## 2. Operation

### A. General

The altitude selector knob on the face of the control adjusts the cabin altitude pointer to the desired cabin altitude. The figure in the small window at the bottom of the dial face will indicate the maximum aircraft altitude at which desired cabin altitude can still be maintained.

The rate control knob adjusts the rate metering valve to the desired rate-of-change setting. Minimum and maximum settings are indicated on the face of the control. The arrow at the centre of the rate control knob range designates the nominal rate setting.

### B. Unpressurized Operation

During normal operation, reference chamber pressure is vented through the atmosphere pressure connection to a region of low pressure.

Setting the cabin altitude pointer to a value above station altitude causes the isobaric bellows to compress, opening the isobaric metering valve. This allows cabin air, which flows into the reference chamber through the cabin air orifice, to flow out through the isobaric metering valve and through the atmosphere pressure connection to atmosphere.

Pressure in the reference chamber is sensed by the outflow/safety valve, through the outflow/safety valve connection, which operates to produce an essentially unpressurized cabin, provided aircraft rate of climb does not exceed selected cabin rate-of-change.

### C. Isobaric Operation

As aircraft cabin pressure enters the isobaric operating range, the isobaric bellows expands and positions the isobaric metering valve to meter reference chamber pressure to atmosphere. With reference chamber pressure maintained essentially constant by the isobaric bellows and metering valve, reference pressure in the outflow/safety valve remains constant and variations in cabin pressure act directly on the outflow/safety valve diaphragm to position the safety valve poppet, thus controlling cabin pressure to the selected cruising altitude.

... Outflow/safety valve controller - Description and operation continued

### D. Selective Pressure Rate-of-Change

When aircraft rate-of-climb exceeds the selected rate, reference pressure is reduced; this results in a pressure differential across the rate control diaphragm because of the restricted flow from the rate chamber to the reference chamber. This pressure differential causes the rate control diaphragm to move the isobaric metering valve to limit flow of air from the reference chamber so that reference pressure will change at the selected rate. The outflow/safety valve reacts to control the rate of change of cabin pressure accordingly.

## 3. Data

| | |
|---|---|
| Isobaric range .... .... .... .... .... | Selective from 1000 ft. below sea level to 10 000 ft. above sea level |
| Selective pressure Rate-of-change control .... .... | 50 to 2000 ft./min.(approx.) |
| Calibration point .... .... .... .... .... .... | 500 ft./min. |

* * *

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## OUTFLOW/SAFETY VALVE CONTROLLER - TROUBLE SHOOTING

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Cabin fails to pressurize. (associated outflow/safety valve open) | Altitude selector knob improperly positioned. | Turn selector knob to desired setting. |
| | Associated outflow/safety valve defective. | Repair or renew outflow/safety valve. |
| | Internal malfunction in outflow/safety valve control. | Renew outflow/safety valve control. |
| Associated outflow/safety valve fails to open, creating excessive cabin pressure. | Loose or damaged pneumatic connections between control and outflow/safety valve. | Repair or renew pneumatic connections. |
| | Associated outflow/safety valve defective. | Repair or renew outflow/safety valve. |
| | Internal malfunction in outflow/safety valve control. | Renew outflow/safety valve control. |
| Outflow/safety valve control fails to maintain selected cabin pressure. | Loose or damaged pneumatic connections between outflow/safety valve and control. | Repair or renew pneumatic connections. |
| | Associated outflow/safety valve defective. | Repair or renew outflow/safety valve. |
| | Internal malfunction in outflow/safety valve control. | Renew outflow/safety valve control. |

* * *

# OUTFLOW/SAFETY VALVE CONTROLLER - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove controller

(1) Isolate controller integral lights electrical circuit (see Chapter 24, GENERAL).

(2) Hinge-open right-hand instrument panel.

(3) Remove plastic cover and disconnect electrical cables from the controller terminals.

(4) Disconnect ambient bleed and cabin air inlet flexible pipelines from the controller.

(5) Disconnect outflow/safety valves sensing pipelines from the controller T-piece.

(6) Remove screws securing controller to the panel, and withdraw controller.

(7) Fit blanks to open pipelines and controller connections.

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### B. Install controller

(1) Remove blanks from pipelines and controller connections.

(2) Position controller in instrument panel, and secure using screws.

(3) Connect outflow/safety valves sensing pipelines to the controller T-piece.

(4) Connect cabin air inlet flexible pipeline to the controller.

(5) Connect ambient bleed flexible pipeline to the controller.

(6) Connect electrical cables to the unit terminals, and fit terminal cover.

(7) Wire-lock controller pipeline unions.

(8) Close and secure instrument panel.

(9) Restore instrument panel electrical circuits.

(10) Functionally test pressurization system (see Chapter 21, PRESSURIZATION CONTROL).

* * *

## OUTFLOW/SAFETY VALVE - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch cabin air pressure safety valve 103278 consists of a base assembly and cover assembly. The base assembly contains an outflow poppet valve, outflow valve diaphragm, outflow valve cover plate, and an atmosphere bleed port. The cover assembly contains an outflow poppet valve spring, pressure relief system, cabin air inlet ports, true static atmosphere port, cabin air inlet orifice and filter connection, and pneumatic relay connection.

The outflow poppet valve and outflow valve cover plate are secured together and suspended on the outflow valve diaphragm. The outflow valve shaft extends through the outflow valve diaphragm and into the outflow valve shaft guide.

The pressure relief system contains a diaphragm assembly, pressure relief valve, and pressure relief adjustment screw.

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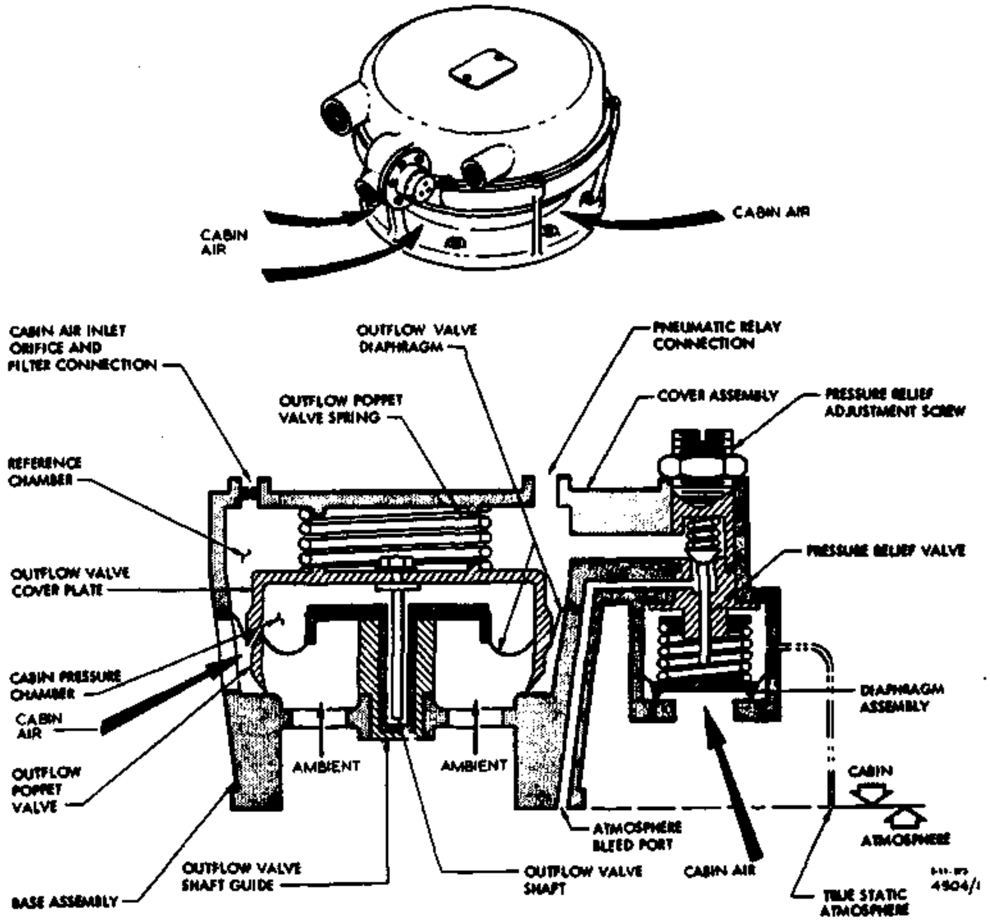

Outflow/safety valve
Fig.1

## 2. Operation

### A. General

Cabin air enters the reference chamber through the cabin air inlet orifice and filter connection and the pressure chamber through apertures around the base assembly and holes in the periphery of the outflow poppet valve and enters the pressure relief system through the cabin air inlet ports. Atmospheric pressure enters the pressure relief system through the true static atmosphere port and the atmosphere bleed port. The bottom face of the outflow poppet valve is also exposed to atmospheric pressure.

### B. Cabin Pressure Relief

If the cabin-to-atmosphere pressure differential exceeds calibrated limits, cabin air pressure must be reduced. With an increase in cabin pressure at the cabin air inlet ports, the cabin-to-atmosphere pressure differential across the diaphragm assembly increases. When the pressure differential reaches the calibrated pressure relief setting, the pressure relief valve unseats, allowing reference chamber air to flow to atmosphere, decreasing reference pressure. The cabin-to-reference pressure differential across the outflow valve diaphragm and outflow valve cover plate opens the outflow poppet valve, allowing cabin air to flow to atmosphere, reducing cabin pressure.

### C. Cabin Vacuum Relief

If the discharge pressure exceeds cabin pressure beyond calibrated limits, cabin air pressure must be increased. With an increase in discharge pressure, the discharge-to-cabin pressure differential across the outflow valve diaphragm opens the outflow poppet valve, allowing discharge pressure to enter the cabin, increasing cabin pressure.

### D. Cabin Dump

If it is desired to reduce cabin pressure to near atmosphere pressure, a manual cabin altitude control valve in the pneumatic relay connection is operated. Reference chamber air escapes to atmosphere, reducing reference chamber pressure. The cabin-to-reference pressure differential across the outflow valve diaphragm and outflow valve cover plate opens the outflow poppet valve, allowing cabin air to flow to atmosphere, reducing cabin pressure to near atmosphere.

## 3. Data

| | |
|---|---|
| Pressure differential setting .. .. .. .. | 8.35 ± 0.20 lb/sq.in. |

* * *

## OUTFLOW/SAFETY VALVE - TROUBLE SHOOTING

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Cabin fails to pressurize | Solenoid air valve open. | Close solenoid air valve. |
| | Filter clogged. | Clean or renew filter. |
| | Excessive cabin leakage. | Locate and seal cabin leaks. |
| | Inadequate air supply to cabin | Repair or adjust air supply equipment. |
| | Foreign object between outflow poppet valve and seat. | Clean outflow poppet valve and seat. |
| | Malfunction of associated cabin pressure control equipment. | Correct malfunction of associated equipment. |
| | Internal malfunction in outflow/safety valve. | Renew outflow/safety valve. |
| Outflow/safety valve fails to relieve cabin air at proper pressure differential. | Sensing lines loose, clogged, or damaged. | Tighten, clean, or renew sensing lines. |
| | Outflow poppet valve jammed or binding. | Renew outflow/safety valve. |
| | Pressure relief adjustment screw out of adjustment. | Renew outflow/safety valve. |
| | Internal malfunction in outflow/safety valve. | Renew outflow/safety valve. |
| Outflow/safety valve leaks excessively. | Foreign object between outflow poppet valve and seat. | Clean outflow poppet valve and seat. |
| | Seating edge of outflow poppet valve damaged. | Renew outflow/safety valve. |
| | Base assembly damaged. | Renew outflow/safety valve. |
| | Internal malfunction in outflow/safety valve. | Renew outflow/safety valve. |

* * *

## OUTFLOW/SAFETY VALVE - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove valve

(1) Gain access to the cabin side of the rear pressure bulkhead.

(2) Disconnect cabin air inlet pipeline from the valve.

(3) Disconnect atmosphere bleed pipeline from the valve pressure relief valve.

(4) Disconnect pneumatic relay pipeline from the valve.

(5) Remove bolts securing the valve to the valve mounting flange, and remove valve and gasket.

(6) If the valve is not being refitted, unscrew and remove pipe connections.

(7) Blank off open pipeline and valve connections.

#### B. Install valve

(1) Remove all blanks.

(2) If applicable, fit pipe connections complete with nuts (where applicable) and packing, to the valve.

(3) Assemble valve complete with gasket to mounting flange; secure valve to mounting flange using bolts and washers.

(4) Connect cabin air inlet pipeline to the valve.

(5) Connect atmosphere bleed pipeline to the valve pressure relief valve.

(6) Connect pneumatic relay pipeline to the valve.

(7) Wire-lock pipe connections and pipeline unions.

(8) Electrically bond pipe lines, as applicable, using P-clips and bonding wire, see DHS 645 (Chapter 20).

(9) Functionally test pressurization system (see Chapter 21, PRESSURIZATION CONTROL).

(10) Refit any equipment removed during operation A(1).

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...Outflow/safety valve - Maintenance practices continued

## 2. Cleaning/Painting

### A. Clean outflow poppet valve

Materials required :-

| | |
|---|---|
| Soft cloth or sponge | |
| Cleaning fluid ... ... ... | NRG + No. 678 Manufactured by :-<br>National Colloid Corporation,<br>P.O. Box 293,<br>Garden Grove,<br>California 92642. |

CAUTION : EXTREME CAUTION MUST BE TAKEN TO PREVENT THE CLEANING SOLUTION FROM ENTERING THE VALVE'S INTERNAL CAVITIES. THEREFORE DURING CLEANING OF THE ASSEMBLED VALVE, ALL SENSE PORTS MUST BE PROTECTED FROM SOLUTION INGESTION.

(1) Using a cloth or sponge soaked in the cleaning solution, wipe the poppet valve and seat.

NOTE : The cleaning fluid can be diluted with water to any consistency necessary to remove the contamination from the valve.

(2) Finally, wipe contamination from the poppet valve and seat using a cloth soaked in water.

(3) To remove heavy contamination it may be necessary to soak the valve base in the cleaning solution.

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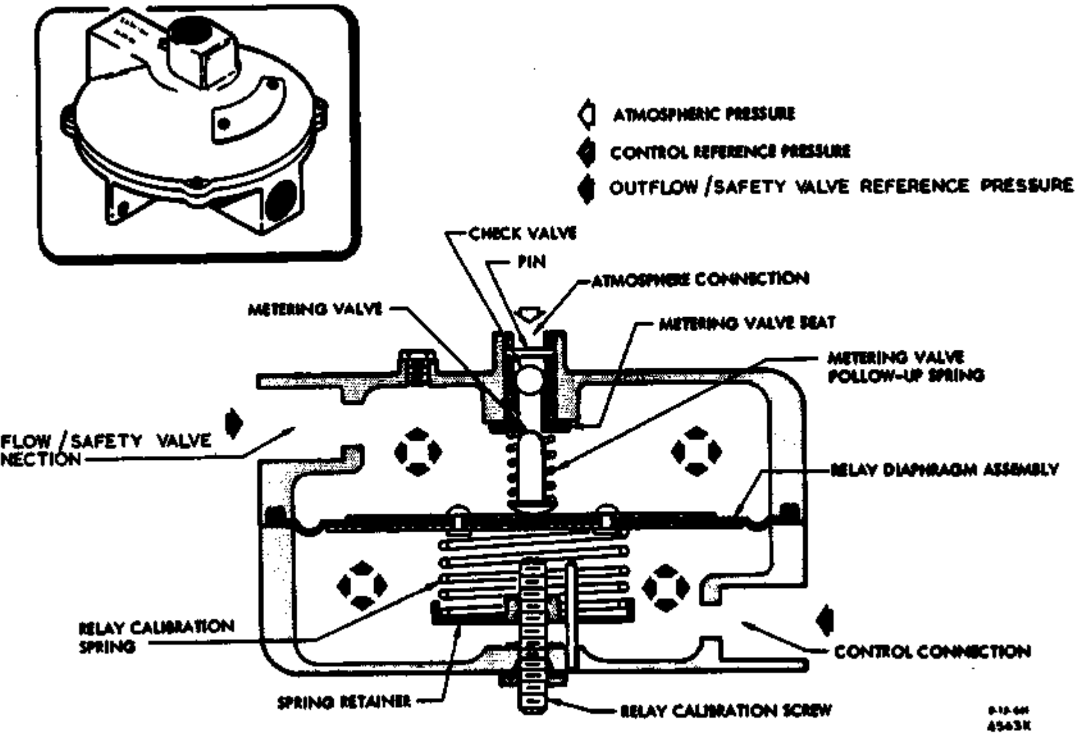
## PNEUMATIC RELAY - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch pneumatic relay 107312 consists of a two-piece housing, a relay diaphragm assembly, a relay calibration assembly, and a metering valve assembly incorporating a check valve.

The housing is separated into two chambers by the relay diaphragm assembly and contains three connections. The safety valve connection and the atmosphere connection are located in the safety valve reference pressure chamber. The control connection is located in the control reference pressure chamber.

The relay diaphragm assembly consists of a diaphragm and two diaphragm back-up plates riveted together. The diaphragm is secured between mating surfaces of the two-piece housing.



Pneumatic relay

Fig.1.

...Pneumatic relay - Description and operation continued

The relay calibration assembly consists of a spring retainer, a relay calibration spring, and a relay calibration screw. The relay calibration screw is threaded into the retainer, passes through the housing, and is secured with a locknut.

The metering valve assembly consists of a metering valve, a metering valve follow-up spring, a metering valve seat, and a check valve. The metering valve is held in constant contact with one of the diaphragm back-up plates by the metering valve follow-up spring. The check valve is held in position within the metering valve seat by a pin.

## 2. Operation

In normal operation, two pressures are applied to the pneumatic relay: a control reference pressure from an outflow valve control, and atmospheric pressure. (See figure 1.) In addition, the safety valve reference chamber in the relay is connected to the reference pressure chamber of a safety valve.

Control reference pressure, established in an outflow valve control, is sensed in the relay through the control connection. Air from the reference pressure chamber in a safety valve flows into the relay through the safety valve connection. As cabin pressure increases, reference pressure in the safety valve and relay increases, creating a pressure differential across the relay diaphragm. When this pressure differential (safety valve reference pressure to control reference pressure) increases sufficiently to overcome the force of the relay calibration spring, the relay diaphragm moves toward the calibration spring allowing the metering valve to open and modulate. The modulation of the metering valve controls the flow of safety valve reference pressure air to atmosphere which controls the safety valve reference pressure. The check valve, located in the metering valve seat, prevents air from entering the safety valve reference pressure chamber through the atmosphere connection.

* * *

## PNEUMATIC RELAY - TROUBLE SHOOTING

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Relay inoperative as indicated by improper safety valve action. | Loose line or connection.<br>Defective associated components.<br>Defective relay. | Tighten line or connection.<br>Renew associated components.<br>Renew relay. |
| Operation of relay erratic as indicated by erratic operation of safety valve. | Pneumatic connection leaking.<br>Defective associated components.<br>Defective relay. | Tighten pneumatic connection.<br>Renew associated components.<br>Renew relay. |

* * *

## PNEUMATIC RELAY - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove relay

(1) Gain access to the cabin side of the rear pressure bulkhead.

(2) Disconnect atmosphere bleed pipeline from the relay.

(3) Disconnect outflow/safety valve reference pressure pipeline(s) from the relay.

NOTE : The relay on the right-hand side of the pressure bulkhead has a T-piece fitted at its outflow/safety valve reference pressure connection to which the manual altitude control valve pipeline is connected.

(4) Disconnect outflow/safety valve controller reference pressure pipeline from the relay.

(5) Remove bolts securing the relay to its mounting brackets, and remove the relay.

(6) Remove pipe connections from the relay.

(7) Fit blanks to the relay and open pipelines.

#### B. Install relay

(1) Remove blanks from the relay and open pipelines.

(2) Fit pipe connections, complete with packing and securing nuts as applicable, to the relay; do not tighten T-piece and elbow connections securing nuts.

(3) Position the relay and secure to mounting brackets using bolts, washers and nuts.

(4) Position relay connections so that pipelines can be connected and tighten connections securing nuts.

(5) Connect atmosphere bleed pipeline to relay connection.

(6) Connect outflow/safety valve controller reference pressure pipeline to relay connection.

(7) Connect outflow/safety valve reference pressure pipeline(s) to relay connection.

(8) Wire-lock relay connections and pipeline unions.

(9) Electrically bond pipelines, as applicable, using P-clips and bonding wire, see DHS 645 (Chapter 20).

...Pneumatic relay - Maintenance practices continued

(10) Functionally test pressurization system (see Chapter 21, PRESSURIZATION CONTROL).

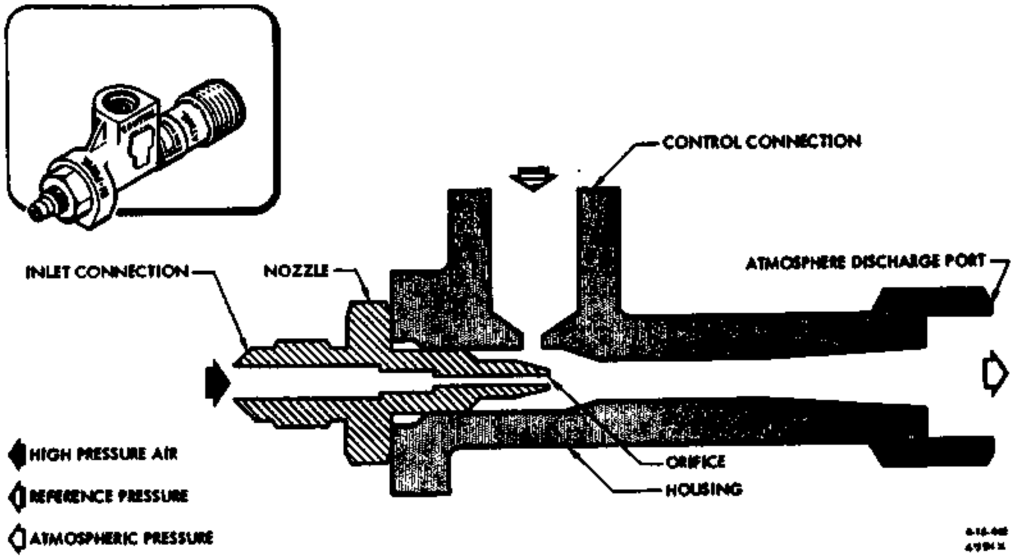
(11) Fit equipment removed during operation A (1).

* * *

# AIR JET PUMP - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch air jet pump 131150 consists of a housing with an integral venturi-shaped cavity and an inlet nozzle with an integral flow restriction orifice.



Air jet pump
Fig.1.

## 2. Operation

High-pressure air enters the high-pressure inlet connection and passes through the orifice to the atmosphere discharge port. Passage of air through the orifice and venturi-shaped cavity reduces the pressure at the control connection.

This reduced pressure is utilized to provide a reference pressure lower than atmospheric pressure to other cabin pressurization components through the control connection.

* * *

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## AIR JET PUMP - TROUBLE SHOOTING

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Insufficient vacuum at control connection. | Loose connection at inlet connection. | Tighten connection. |
| | Obstructed line to inlet connection or from atmosphere discharge port. | Remove obstruction. |
| | Defective jet pump. | Renew jet pump. |

* * *

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## AIR JET PUMP - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove jet pump

(1) Gain access to the cabin side of the rear pressure bulkhead.

(2) Disconnect high-pressure air inlet pipeline from the jet pump.

(3) Disconnect pipeline from the elbow at the jet pump control connection.

(4) Unscrew special-fitting nut securing jet pump to ambient port assembly, and remove jet pump.

(5) Remove elbow connection from jet pump control port.

(6) Fit blanks to jet pump and open pipelines.

#### B. Install jet pump

(1) Remove blanks.

(2) Fit elbow connection, complete with packing or O-ring seal, as applicable, and nut, to the jet pump control port; do not tighten nut.

(3) Fit a serviceable O-ring seal, engage jet pump in special fitting nut and secure by tightening nut; wire-lock nut.

(4) Position elbow so that the pipeline can be connected to it, and tighten elbow securing nut.

(5) Connect pipeline to elbow connection.

(6) Connect air inlet pipeline to the jet pump.

(7) Wire-lock pipeline unions and pump connection.

(8) Electrically bond pipelines, as applicable, using P-clips and bonding wire, see DHS 645 (Chapter 20).

#### C. Checks/Tests after installation

Materials required:

| | |
|---|---|
| Leak testing solution .. .. | 5% Nonidet LE<br>95% Distilled water |

(1) Start an engine (see Chapter 71), and set throttle to ground idle.

(2) Using leak testing solution check the high-pressure air inlet connection to the jet pump for leaks.

(3) Thoroughly wash off leak test solution using distilled water.

(4) Shut down engine.

(5) Refit any equipment removed during operation A(1).

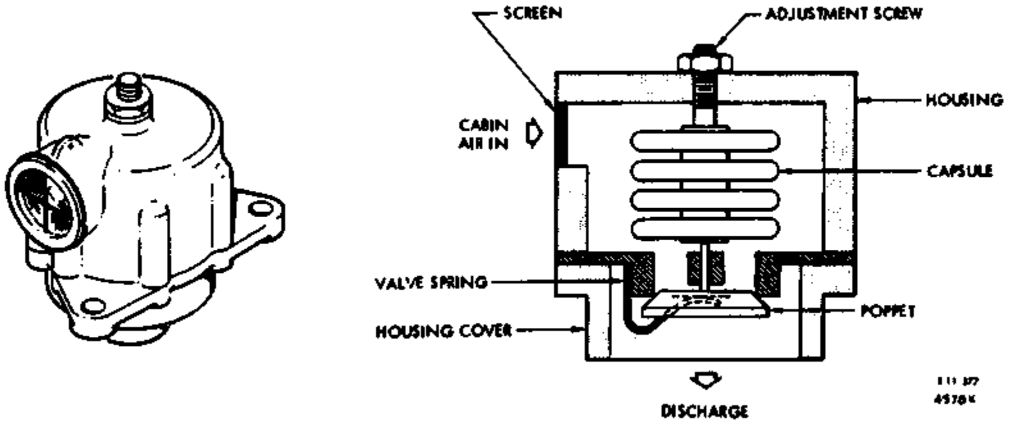
* * *

# PRESSURE REGULATOR - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch absolute air pressure regulator 102466 contains an evacuated capsule, poppet, and valve spring enclosed in a housing, and a housing cover. A cabin air pressure inlet and filter port is located in the housing, and a cabin air pressure outflow/safety valve discharge port is located in the housing cover.

The valve spring holds the poppet on its seat. The capsule is positioned to a calibrated setting by an adjustment screw set to open the poppet at the calibrated cabin air pressure.



Pressure regulator
Fig.1.

## 2. Operation

Air at cabin pressure enters the regulator housing through a screened port, exerting pressure on the evacuated capsule. A valve spring forces the poppet against the valve seat. As cabin air pressure decreases to less than the calibrated setting of the regulator, the capsule expands, overcoming the spring force against the poppet and raising the poppet from the valve seat. With the poppet open, cabin air flows through the regulator to a safety outflow valve. As cabin air pressure increases beyond the calibrated setting of the regulator, the capsule contracts, allowing the valve spring force to seat the poppet, stopping air flow through the regulator.

## 3. Data

Calibrated cabin air pressure (connected to outflow/safety valve) ... 13500±1500 feet

* * *

## PRESSURE REGULATOR - TROUBLE SHOOTING

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Regulator inoperative. | Filter screen clogged. | Clean or renew filter screen. |
| | Internal malfunction in regulator. | Renew regulator. |

* * *

## PRESSURE REGULATOR - MAINTENANCE PRACTICES

### 1. Unit servicing

Materials required:

| | |
|---|---|
| Cleaning solvent .. .. .. | Federal Spec. P-D-680 or equivalent. |

#### A. Service filter screen

(1) Remove filter screen from regulator.

(2) WARNING: USE DRY CLEANING SOLVENT IN A WELL VENTILATED AREA, AVOID INHALING FUMES, AND KEEP AWAY FROM FLAMES.

Clean filter screen using cleaning solvent and dry thoroughly with compressed air.

(3) Fit filter screen to regulator.

### 2. Removal/Installation

#### A. Remove regulator

(1) Gain access to the cabin side of the rear pressure bulkhead.

(2) Disconnect pipelines from T-piece connection or pipeline from pipe connection, as applicable.

(3) Remove bolts securing regulator to mounting, and remove regulator.

(4) Remove T-piece connection or pipe connection from the regulator.

(5) Fit blanks to regulator and open pipeline(s).

#### B. Install regulator

(1) Remove blanks and ensure that the regulator filter screen is clean and undamaged.

(2) Fit T-piece connection or pipe connection, as applicable, complete with nut and packing, or O-ring seal, as applicable, to the regulator; do not tighten nut.

(3) Secure regulator to mounting using bolts.

(4) Position T-piece or pipe connection so that the pipeline(s) can be connected, and tighten securing nut.

(5) Connect pipeline(s) to T-piece or pipe connection and wire-lock.

(6) Electrically bond pipelines, as applicable, using P-clips and bonding wire, see DHS 645 (Chapter 20).

(7) Fit equipment removed in operation A(1).

* * *

## FAN OPERATED VENTURI - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch fan and venturi tube 132322 consists primarily of a motor-driven vaneaxial fan, a capacitor, and a venturi tube assembly.

The motor-driven vaneaxial fan comprises an alternating-current motor stator assembly, a rotor assembly, and a seven-bladed axial fan impeller attached to the rotor shaft. The rotor shaft is aligned by an annular ball bearing at each end. The complete assembly is contained within a vaneaxial fan housing with eight vanes, and inlet and discharge ports.

The capacitor and the electrical connector are attached to a bracket. The bracket is positioned between the fan housing flange and the venturi tube flange.

The venturi tube assembly comprises a venturi tube, a low pressure port, and a bracket for attachment to the aircraft. The low pressure port consists of an internally-threaded boss brazed to the venturi tube throat. The attachment bracket is brazed to the venturi tube inlet end.

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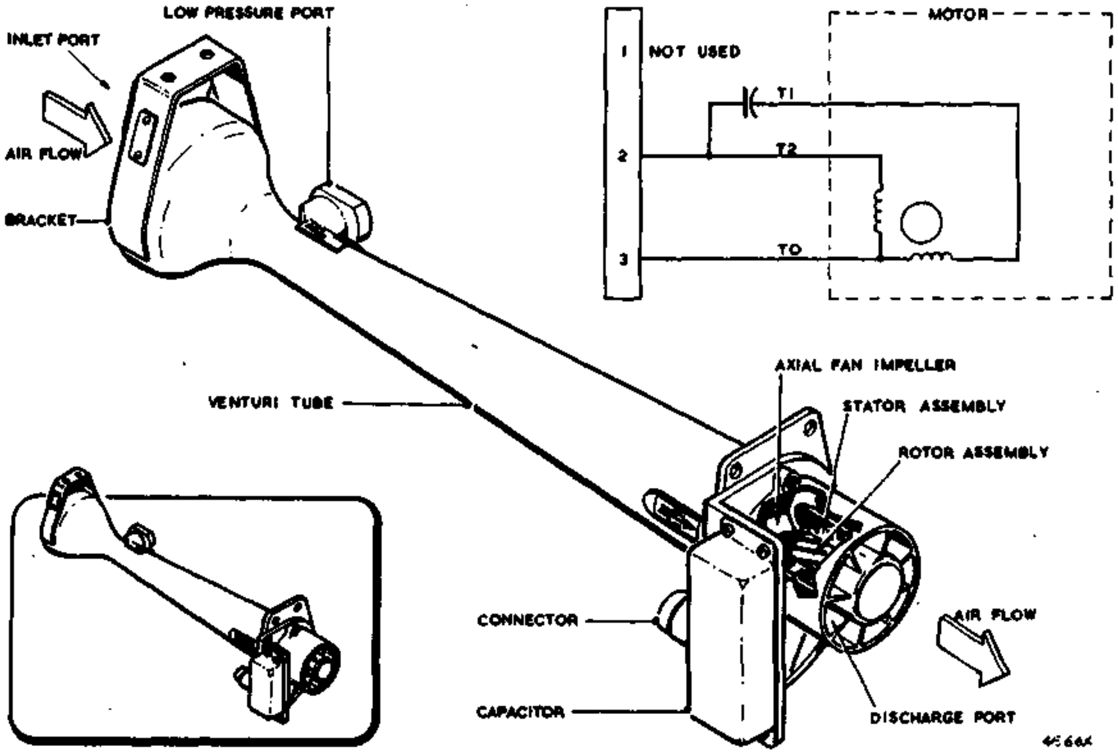

Fan operated venturi
Fig.1.

...Fan operated venturi - Description and operation continued

## 2. Operation

When voltage is applied at pins 2 and 3 of the electrical connector, the vaneaxial fan rotates at high speed. An airflow is induced through the venturi tube, and the resultant pressure drop at the venturi tube throat is utilized as a low reference pressure for operation of other components of the pressurization system.

Airflow through the venturi tube cools the motor and discharges through the fan discharge port.

## 3. Data

| | | |
|---|---|---|
| Fan operating voltage | | 115 V ac, 400 cps, single phase. |
| Fan operating current | | |
| | Start | 2.50 amp (max.) |
| | Run | 0.70 amp (max.) |
| Fan speed | | 22 200 r.p.m. (min.) |
| Fan rotation | | Counter clockwise (viewed from fan inlet) |

* * *

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## FAN OPERATED VENTURI - TROUBLE SHOOTING

| Trouble | Probable Cause | Remedy |
|---|---|---|
| Unit fails to operate. | Failure of power supply, or defective electrical connections. | Restore power supply; check and repair electrical connections. |
| | Defective unit. | Renew unit. |
| Unit current drain exceeds rated value as evidenced by blown fuses or open circuit breakers. | Excessive load due to restricted airflow. | Check inlet and discharge ports; remove obstruction. |
| | Defective unit. | Renew unit. |
| Incorrect pressure at low pressure port. | Loose connection at low pressure port. | Tighten connection. |
| | Restricted airflow. | Check inlet and discharge ports; remove obstruction. |
| | Defective unit. | Renew unit. |

* * *

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# FAN OPERATED VENTURI - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Removal

(1) Gain access to the cabin pressure bulkhead.

(2) On panel DA/D, open circuit breaker PRESSN VENTURI FAN (Chapter 24, GENERAL).

(3) Disconnect electrical plug from venturi socket.

(4) Disconnect pipelines from T-piece connection.

(5) Remove bolts that attach the venturi to its mounting brackets, and remove venturi.

(6) Disconnect T-piece connection from the venturi.

(7) Install blanks to venturi and pipelines.

### B. Installation

(1) Remove blanks.

(2) Install T-piece connection complete with nut and O-ring seal to the venturi; do not tighten nut.

(3) Install venturi to mounting brackets using bolts, washers and nuts.

**CAUTION: PRE-MOD. 253514A AIRPLANES ONLY. MAKE SURE THERE IS A MINIMUM CLEARANCE OF 1.0 IN. BETWEEN THE MOTOR OF THE FAN VENTURI AND LOCALIZED FURNISHINGS.**

(4) Position T-piece so that the pipelines can be connected, and tighten securing nut.

(5) Connect pipelines to T-piece connection.

(6) Wirelock T-piece connection and pipeline unions.

(7) Electrically bond pipelines, as applicable, using P-clips and bonding wire (Chapter 20, ELECTRICAL BONDING)

(8) Connect electrical plug to the venturi socket.

(9) Close circuit breaker.

(10) Do a functional test of the venturi fan (ADJUSTMENT/TEST).

(11) Install any equipment removed in paragraph A.1.

## 2. Adjustment/Test

### A. *Function test fan operated venturi*

(1) Energize relevant a.c. busbars (Chapter 24, GENERAL).

(2) Select No.1 or 2 INVERTER to START.

(3) Select fan venturi PRESS MODE switch to GND and check that the fan operates.

(4) Select PRESS MODE switch to FLT and check that fan stops.

(5) Select INVERTER to STOP.

(6) De-energize a.c. busbars (Chapter 24, GENERAL).

## GROUND PRESSURE TEST VALVE - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove valve

(1) Remove pilots' right-hand console side panel.

(2) Disconnect pipelines from the valve.

(3) Remove bolt and withdraw valve operating lever.

(4) Remove bolts securing valve to console and remove valve, and packing if fitted.

(5) Remove straight connections from the valve.

(6) Fit blanks to valve and open pipelines.

#### B. Install valve

(1) Remove blanks.

(2) Fit straight connections, complete with locknuts and O-ring seals, to the valve.

(3) Close valve.

(4) Position valve and packing, if applicable, and secure to console using bolts.

(5) Connect pipelines to valve connections.

(6) Wire-lock pipeline unions and valve connections.

(7) Fit operating lever to the valve, the lever is keyed to the valve and may be shimmed (max 0.05 in.); tighten the lever securing bolt.

(8) Functionally test pressurization system (see Chapter 21, PRESSURIZATION CONTROL).

(9) Fit console side panel.

* * *

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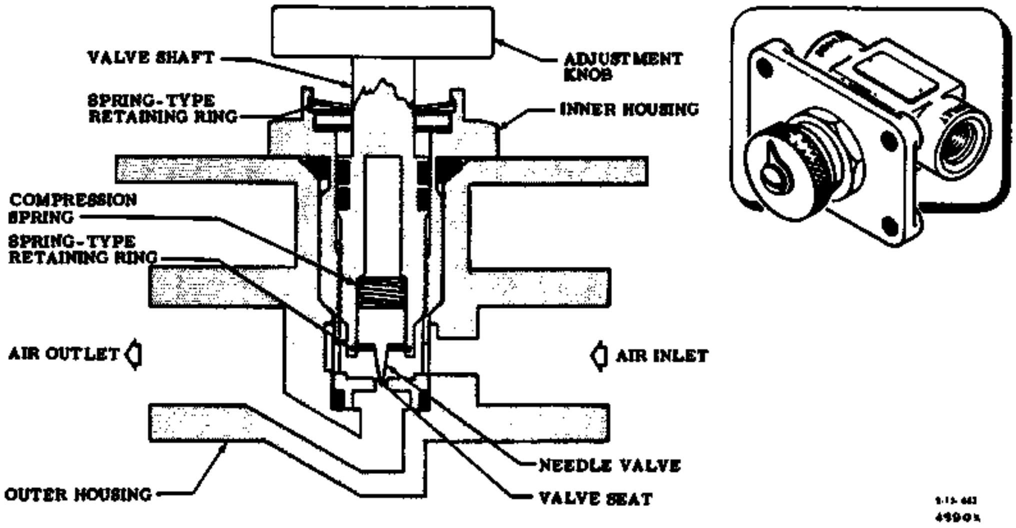
## MANUAL CABIN ALTITUDE CONTROL VALVE - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch air needle valve 131004 consists of an outer housing with air inlet and outlet connections, an adjustment knob, and a valve shaft. The valve shaft is turned by the knob to seat a needle valve. The needle valve is spring-loaded inside the bottom end of the shaft by a compression spring.

The needle valve is retained inside the valve shaft by a spring-type retaining ring. The valve shaft is retained inside the inner housing by a spring-type retaining ring.



Manual cabin altitude control valve
Fig. 1

### 2. Operation

As the valve is opened, air enters the inlet connection in the side of the valve housing and flows through the valve seat opening and out the atmosphere connection.

The valve is operated by turning the knob on top of the valve counter-clockwise to open the valve. To open the valve fully from the closed position requires approximately seven complete turns. A pointer on top of the knob gives indication of internal valve position. The pointer is 90 to 105 degrees counter-clockwise from the inlet connection when air begins to flow through the valve.

Further clockwise rotation of the valve shaft, after the valve is seated, compresses the spring in the end of the valve shaft; this prevents manual jamming of the valve on its seat.

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## MANUAL CABIN ALTITUDE CONTROL VALVE - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Valve binds during rotation | Valve threads galling | Renew valve |
| No airflow through valve when opened | Valve clogged with foreign material | Clean valve ports and passages |
| | Needle valve remains seated because of broken or unseated retaining ring | Renew valve |
| | Insufficient air supply | Ensure proper supply of air to valve |

* * *

# MANUAL CABIN ALTITUDE CONTROL VALVE - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove control valve

(1) Remove pilots' right-hand console side panel.

(2) Disconnect pipelines from the control valve.

(3) Remove bolts securing valve to console, and remove valve and packing, if fitted.

(4) Remove straight connections from the valve.

(5) Fit blanks to valve and open pipelines.

### B. Install control valve

(1) Remove blanks.

(2) Fit straight connections, complete with locknuts and O-ring seals, to the control valve.

(3) Position valve so that the venturi pipeline will connect to the valve ATMOS connection, and the outflow/safety valve reference chamber pipeline to the valve INLET connection. Fit packing, if applicable, and secure valve to console using bolts.

(4) Connect pipelines to valve connections.

(5) Wire-lock pipeline unions and valve connections.

(6) Functionally test pressurization system (see Chapter 21, PRESSURIZATION CONTROL).

(7) Fit console side panel.

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## VENTURI - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch air flow venturi 131052 consists of a venturi assembly and a protective screen assembly.

The venturi assembly is an aluminium casting with a passage that starts at the cabin air-in port and tapers sharply to a narrow neck, where there is a small opening to the low-pressure port. The passage then gradually increases in diameter to the ambient pressure port. The ambient pressure port is externally threaded, and the low-pressure port is internally threaded. The cabin air-in port provides a means of mounting the protective screen assembly to the venturi assembly.

The protective screen assembly consists of a square-mesh wire-screen basket with a flange for mounting.

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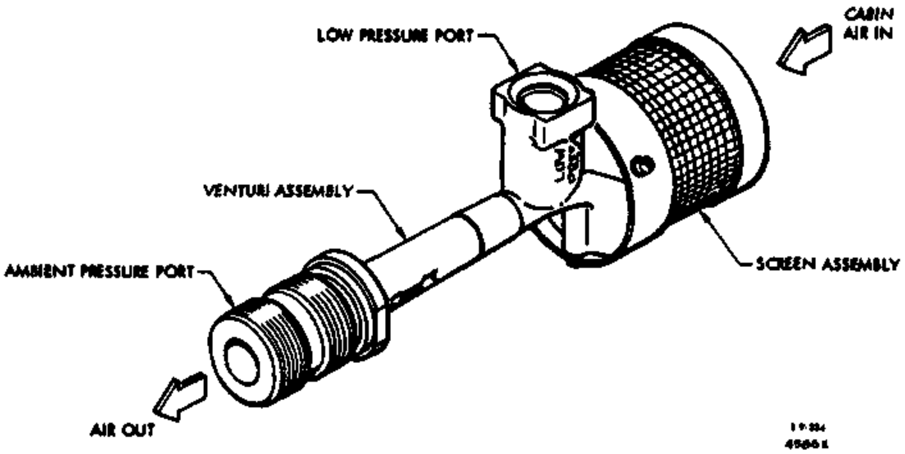

Venturi
Fig. 1

### 2. Operation

Air flowing through the venturi from the cabin air-in port to the ambient pressure port provides a pressure at the low pressure port that is less than cabin air pressure.

### 3. Data

| | |
|---|---|
| Minimum pressure differential below cabin pressure with cabin to ambient pressure differential of 3.70 in. of water ... | 12 in. of water |

* * *

## VENTURI - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Insufficient vacuum at low pressure port. | Loose connection at low pressure port. | Tighten connection. |
| | Obstructed screen assembly. | Remove obstruction. |
| | Obstructed venturi assembly. | Remove obstruction. |

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## VENTURI - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove venturi

(1) Disconnect pipeline from elbow connection at the venturi low-pressure port.

(2) Slacken locknut and unscrew venturi from adapter.

(3) Remove elbow connection from venturi.

#### B. Install venturi

(1) Fit elbow connection, complete with locknut and packing, to the venturi; do not tighten locknut.

(2) Fit venturi, complete with locknut and packing, to the adapter; do not tighten locknut.

(3) Position venturi and elbow so that the pipeline can be connected, then tighten elbow connection and venturi securing locknuts.

(4) Connect pipeline to elbow connection.

(5) Wire-lock venturi and elbow connection securing nuts and pipeline union.

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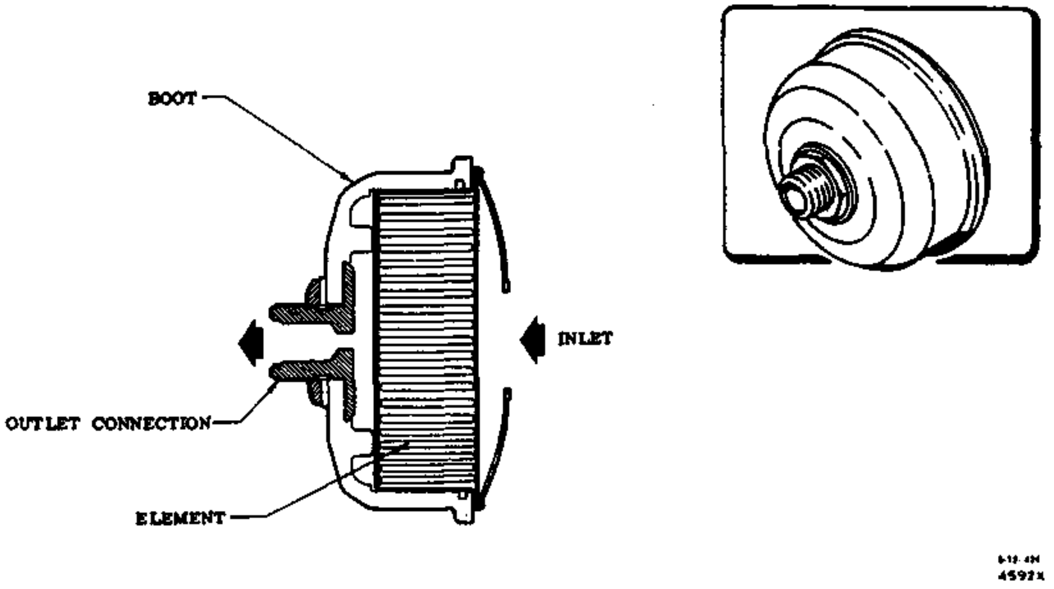
# CABIN AIR FILTER - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch air filter 135157 consists of a casing (boot) filter element cartridge, and an outlet connection. The filter element cartridge consists of a filter element and a nylon screen.



Air filter
Fig. 1

## 2. Operation

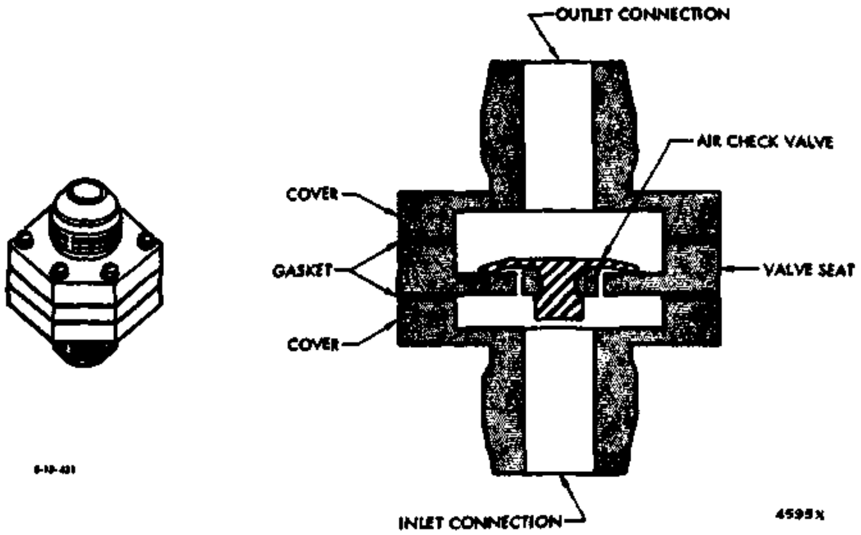
Air enters the filter and passes through the filter element and nylon screen. The nylon screen prevents large particles of foreign matter from entering the cabin air sensing port. The filter element prevents fine particles of foreign matter and tobacco tars from entering the cabin air sensing port.

* * *

## CHECK VALVE - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch check valve 130156 contains an air check valve, valve seat, gaskets, and two covers. The air check valve is attached to the centre of the valve seat with the seating surface of the air check valve contacting the valve seat.



Check valve
Fig. 1

### 2. Operation

When the pressure differential across the valve reaches the calibrated value, the air check valve is lifted off the valve seat, allowing airflow through the valve.

If the pressure differential across the valve is reversed, airflow is prevented by the pressure holding the air check valve on the valve seat.

* * *

## DUMP VALVE AND CONTROL MECHANISM - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove dump valve

(1) Remove flight compartment right-hand seat from seat rails (see Chapter 25, FLIGHT COMPARTMENT) and remove inboard floor panel.

(2) Disconnect connecting rod from valve operating lever arm.

(3) Slacken hose clips at inlet end of valve and slide pipe connector along inlet duct to clear valve.

(4) Remove bolts securing valve to outlet duct flange and remove valve.

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#### B. Checks/Tests before installation

Materials required:

| | |
|---|---|
| Thiokol .. .. .. .. | PR 1422 BT½ |

(1) Check that operating lever arm is fitted to valve spindle hexagon so that lever movement is 45° either side of valve axis and that lever is pointing toward inlet end of valve.

(2) Check that valve operating lever arm is firmly secured with washer and nut.

(3) Clean mating surfaces of valve and outlet duct flange and apply Thiokol in accordance with HSA S26-1002 (see Chapter 20).

#### C. Install dump valve

(1) Position valve flange on outlet duct flange and fit securing bolts.

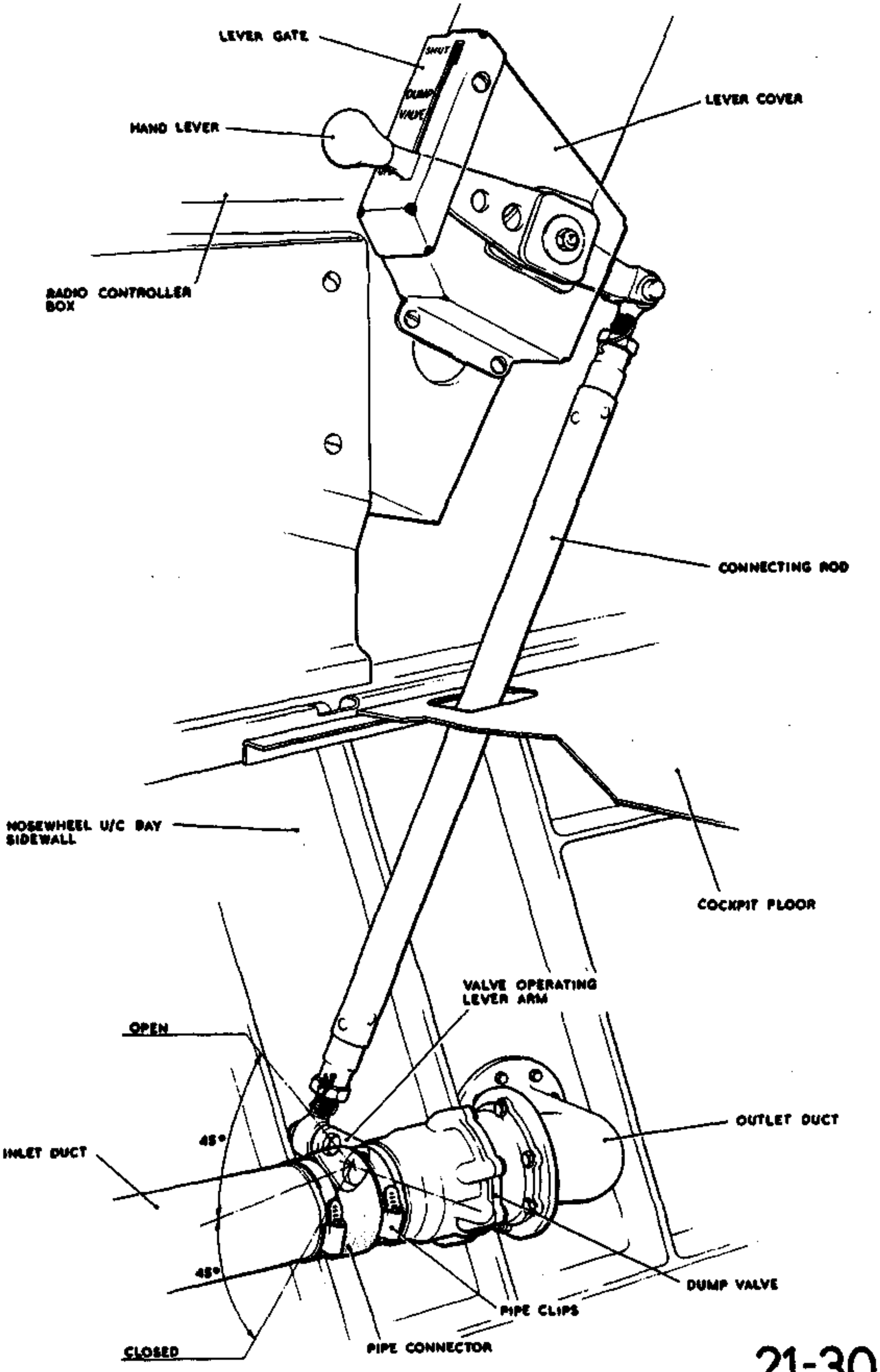
(2) Fit pipe connector over inlet end of valve and inlet duct and secure using hose clips.

(3) Attach connecting rod to valve operating lever arm.

(4) Adjust connecting rod as necessary to ensure that with the hand lever in the SHUT position the valve is fully closed and that there is a full range of movement to the OPEN position. Check rod ends are in safety, tighten locknuts and wire-lock.

(5) Operate hand lever between SHUT and OPEN position, and check for full and free movement. Return lever to SHUT position.

(6) Fit inboard floor panel and right-hand seat (see Chapter 25, FLIGHT COMPARTMENT).



Dump valve removal and installation
Fig.201

# TEMPERATURE CONTROL - DESCRIPTION AND OPERATION

## 1. Description (Ref.Figs 1 & 2)

Air for conditioning the cabin and flight compartments is taken from the LP and HP compressors of each engine. The temperature of this air is adjusted to maintain a constant selected air temperature in the cabin and flight compartment by two valves, a turbine by-pass valve and a refrigeration unit by-pass valve, in association with a refrigeration unit comprising a cooling turbine and an air-to-air heat exchanger.

Operation of the valves can be effected either automatically or manually by selection of a CABIN TEMP AUTO/MANUAL switch (located on the main roof switch panel).

Both valves are electrically interconnected, so that, until the turbine by-pass valve has motored to the almost fully open position the refrigeration unit by-pass valve cannot commence to open. Conversely, the refrigeration unit by-pass valve must almost fully close before the turbine by-pass valve can commence to close.

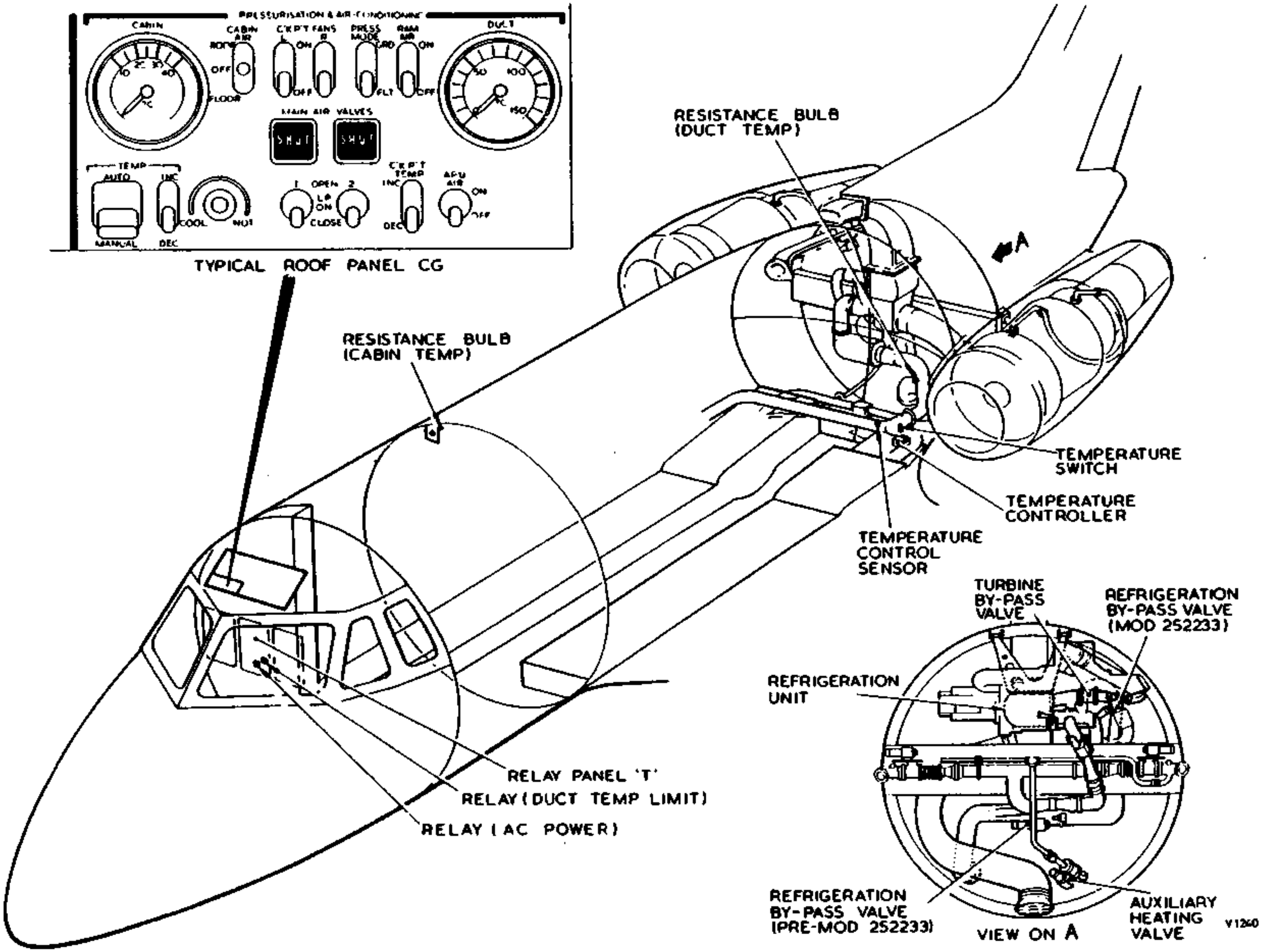
A CABIN TEMP CONTROL selector, with selections annotated COOL and HOT, is located on the PRESSN & AIR CONDITIONING section of the main roof switch panel,provides the means of selecting cabin temperature. The selector is connected to the first stage magnetic amplifier of the cabin temperature controller, as is a temperature control sensor unit, installed in the main air supply ducting.

The temperature controller, on receipt of signals from the selector and sensor unit, determines whether a temperature increase or decrease is necessary. It then sends an electrical supply, through a duct temperature limit relay, to close or open the contacts of the turbine by-pass and refrigeration unit by-pass valves, causing them to motor to the positions required to maintain the selected cabin delivery air temperature. When the system operates in the manual mode, the INC-DEC switch, located next to the AUTO/MANUAL selector switch, will control the temperature. The INC-DEC switch is a two pole type and is biased to off from both selective positions.

If the temperature in the main air supply ducting exceeds the permitted limit, a temperature switch fitted in the ducting operates and makes the duct temperature limit relay energize and isolate the electrical supply to the open contacts of the turbine by-pass valve. An electrical supply then closes the contacts of the refrigeration unit by-pass valve. This causes both valves to close. When the temperature falls below the permitted limit the circuit returns to normal. The main air supply duct temperature limits are:

240 ±10 deg.F (115.6 ±5.6 deg.C) Mod.252455
222 ±10 deg.F (105.6 ±5.6 deg.C) Mod.253293A
220 ±10 deg.F (104 ±5.6 deg.C) Mod.252438
200 ±10 deg.F (93.3 ±5.6 deg.C) Pre-Mod.252438

An auxiliary heating system with an electrically operated valve is available for the flight compartment. Control of the valve is from a switch annotated CKPT TEMP with selections INC-DEC, located on the PRESSN & AIR CONDITIONING section of the main roof switch panel. A check (non-return) valve prevents this supply feeding into the main air supply duct.



Temperature control system
Fig.1

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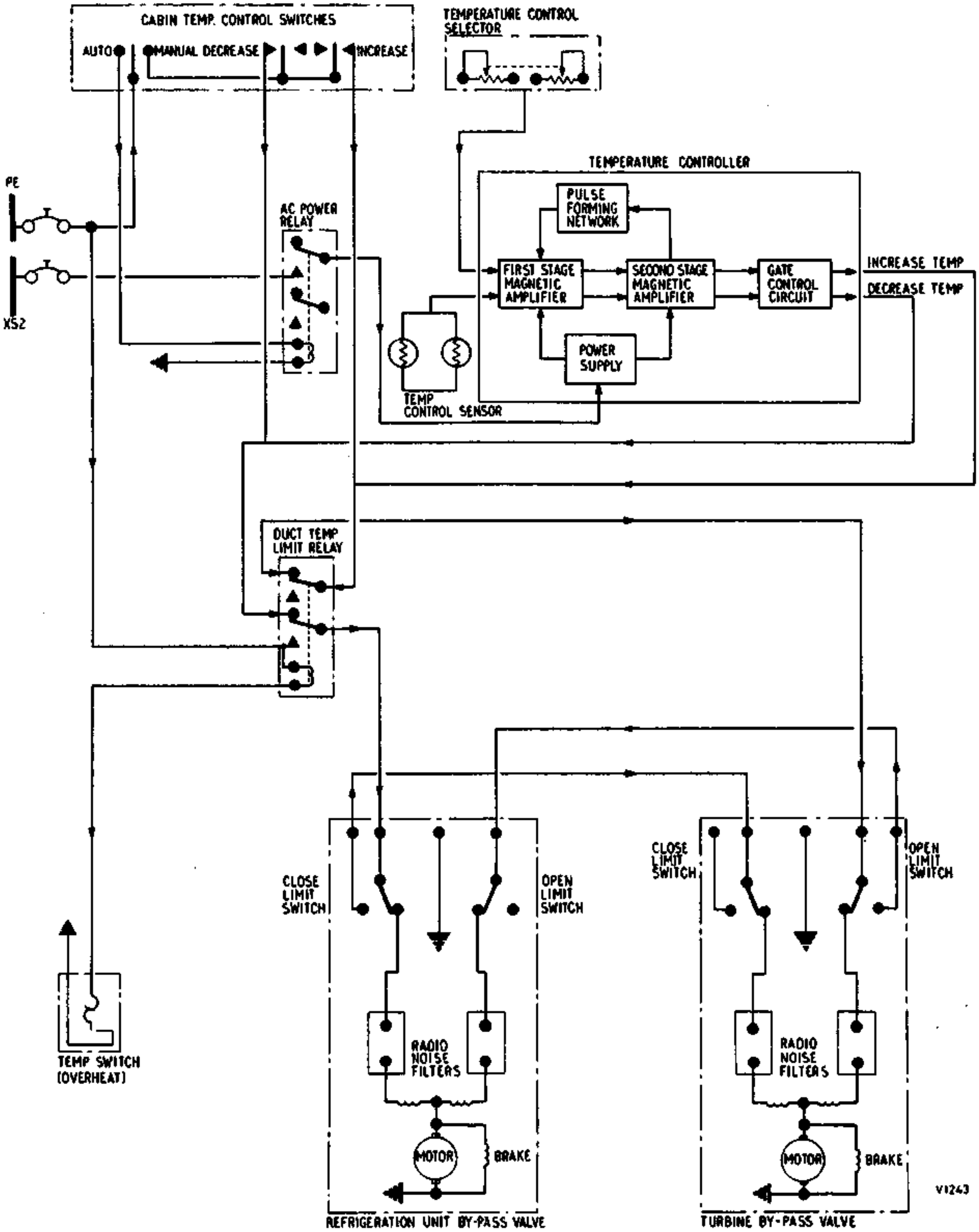

Temperature control schematic diagram
Fig.2

...Temperature control - Description and operation continued

Resistance bulbs, fitted in the inlet supply duct immediately aft of the rear pressure dome and in the passenger cabin, are connected to indicators labelled DUCT and CABIN, situated on the PRESSN & AIR CONDITIONING section of the main roof switch panel.

## 2. Operation

### A. Auto

With busbars PE and XS2 energized and the AUTO/MANUAL switch selected to AUTO, the a.c. power relay is energized and a.c. fed to the temperature controller.

The temperature controller on receipt of signals from the temperature selector and temperature control sensor determines whether a temperature increase or decrease output is required. The controller first stage magnetic amplifier temperature-increase channel or temperature-decrease channel, as appropriate, then transmits a signal to the corresponding channel of the second stage magnetic amplifier. This amplifier increases the signal and transmits it to the gate control circuit, which then delivers, via the duct temp relay a high current output to either the open contacts of the turbine by-pass valve or close contacts of the refrigeration unit by-pass valve. Both valves or either one of the valves, depending upon the magnitude of the difference between the actual cabin temperature and that selected, motor to the position necessary to maintain cabin temperature at the required level. As the temperature leaves the required level, the magnetic amplifiers, in conjunction with the pulse forming network, generate short duration pulses; the farther away the temperature departs from the required level the longer the output pulses become, until a continuous output is obtained. The pulse system allows incremental actuation of the system valves, thereby stabilizing the temperature in a narrow band and preventing oscillation above and below the desired band width.

### B. Manual

With the AUTO/MANUAL switch selected to MANUAL and busbar PE energized, a d.c. supply is fed to the INCREASE-DECREASE switch.

Making a selection to INCREASE feeds a d.c. supply, via the duct temp limit relay, to the turbine by-pass valve open contacts, and a selection to DECREASE feeds a d.c. supply to the refrigeration unit by-pass valve close contacts.

On attaining the required cabin delivery air temperature, the switch may be released as the valves are held in the selected position by an integral magnetic brake.

### C. System overheat

With the system in operation, a d.c. supply is fed, via the energizing coil of the duct temperature limit relay, to the temperature switch.

If the temperature of the air in the main supply duct increase to:

240 ±10 deg.F (115.6 ±5.6 deg.C) Mod.252455
222 ±10 deg.F (105.6 ±5.6 deg.C) Mod.253293A
220 ±10 deg.F (104 ±5.6 deg.C) Mod.252438
200 ±10 deg.F (93.3 ±5.6 deg.C) Pre-Mod.252438 and 252455

the temperature switch contacts close and complete the relay energizing coil circuit to earth, thus energizing the relay.

With the relay energized the electrical supply to the open contacts of the turbine by-pass valve is cut-off and a supply fed to the close contacts of the refrigeration unit by-pass valve. The valves due to their electrical interconnection, motor to the closed position to shut off the hot air supply until such time that the delivery air temperature reduces sufficiently to cause the temperature switch contacts to open and open circuit the duct temperature limit relay, de-energizing it and restoring normal supply to the valves.

## TEMPERATURE CONTROL - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Functionally test temperature control system (without air supplies)

(1) Energize a.c. and d.c. busbars (see Chapter 24, GENERAL).

(2) Select AUTO/MANUAL switch to MANUAL.

(3) Hold CABIN TEMP-INC-DEC switch to DEC for approximately 45 seconds and release switch. Hold the switch to INC position and check that the turbine by-pass valve fully opens within 7 to 14 seconds and that the refrigeration unit by-pass valve is fully open 10 to 14 seconds later.

(4) Hold the CABIN TEMP-INC-DEC switch to DEC position, and check that the refrigeration unit by-pass valve fully closes within 10 to 14 seconds, and that the turbine by-pass valve is fully closed 7 to 14 seconds later.

(5) Check that the valves can be stopped in any intermediate position by intermittent operation of the INC-DEC switch, towards INC and then towards DEC. Leave valves in the closed position.

(6) Select AUTO/MANUAL switch to AUTO.

(7) Select CABIN TEMP selector to HOT, and check that the turbine by-pass valve and the refrigeration unit by-pass valve move to the fully open position.

(8) Select CABIN TEMP selector to COOL, and check that the refrigeration unit by-pass valve and turbine by-pass valve move to the fully closed position.

(9) De-energize busbars.

### B. Functionally test temperature control system (with air supplies)

(1) Close entrance door, and ensure that the d.v. windows and escape hatch are closed.

(2) Start engines (see Chapter 71, GENERAL) or the auxiliary power unit (see Chapter 49, GENERAL).

(3) Set the engine throttles to ground idle position.

(4) Select No.1 or 2 INV switch to START.

(5) Select fan operated venturi on by operating PRESS MODE switch on the PRESSN & AIR CONDITIONING section of the main roof switch panel to GRD. This ensures that the pressurization normal and emergency outflow/safety valves open to permit the discharge of cabin air.

...Temperature control - Maintenance practices continued

(6) If using engine air supply, select both engine MAIN AIR VALVES switches on the PRESSN & AIR CONDITIONING section of the main roof switch panel to OPEN. Check that the air valves magnetic indicators, situated above the switches, indicate OPEN. If using APU air supply, select APU AIR switch to ON.

(7) Select AUTO/MANUAL switch to AUTO.

(8) Select CABIN TEMP selector to a mid-position between COOL and HOT. Note the temperature reading on the inlet DUCT indicator.

(9) Select CABIN TEMP selector to COOL, and check that the refrigeration unit by-pass valve and/or the turbine by-pass valve motor to the closed position. Check that a temperature drop is indicated on the inlet DUCT indicator.

NOTE : The refrigeration unit by-pass valve may not have been required to open in order to attain the temperature selected in operation (8), in this case the turbine by-pass valve only will operate in operation (9).

(10) Select CABIN TEMP selector to HOT, and check that the turbine by-pass valve followed by the refrigeration unit by-pass valve motor to the open position. Check that a rise in temperature is indicated on the inlet DUCT indicator.

(11) Select CABIN TEMP selector to a mid position, and check that a temperature drop is indicated on the inlet DUCT indicator.

(12) Select AUTO/MANUAL switch to MANUAL.

(13) Operate CABIN TEMP-INC-DEC switch to INC and DEC in turn, and check that there is a corresponding rise and fall in temperature indicated on the inlet DUCT indicator. Operate switch to DEC to fully close both the refrigeration unit by-pass valve and the turbine by-pass valve.

(14) Select MAIN AIR VALVES switches to CLOSE, and check that the valve position magnetic indicators indicate SHUT, or select APU AIR switch to OFF.

(15) Switch off fan venturi by selecting PRESS MODE switch to FLT.

(16) Select INV switch to STOP.

(17) Shut down engines (see Chapter 71, GENERAL) or auxiliary power unit (see Chapter 49, GENERAL).

C. Functionally test overheat system

(1) Energize d.c. busbar (see Chapter 24, GENERAL).

(2) Select AUTO/MANUAL switch to MANUAL.

(3) Hold the CABIN TEMP-INC-DEC switch to INC position until the turbine by-pass and refrigeration unit by-pass valves are open.

(4) De-energize d.c. busbar.

(5) Link temperature switch terminals A and B.

(6) Energize d.c. busbar, and check that both the refrigeration unit and turbine by-pass valves close.

(7) De-energize d.c. busbar.

(8) Remove link from the temperature switch terminals.

(9) Hold the CABIN TEMP-INC-DEC switch to INC position.

(10) Energize d.c. busbar, and check that the turbine by-pass and refrigeration unit by-pass valves open.

(11) Hold the CABIN TEMP-INC-DEC switch to DEC position, and check that the refrigeration unit by-pass and turbine by-pass valves close.

(12) De-energize d.c. busbar.

* * *

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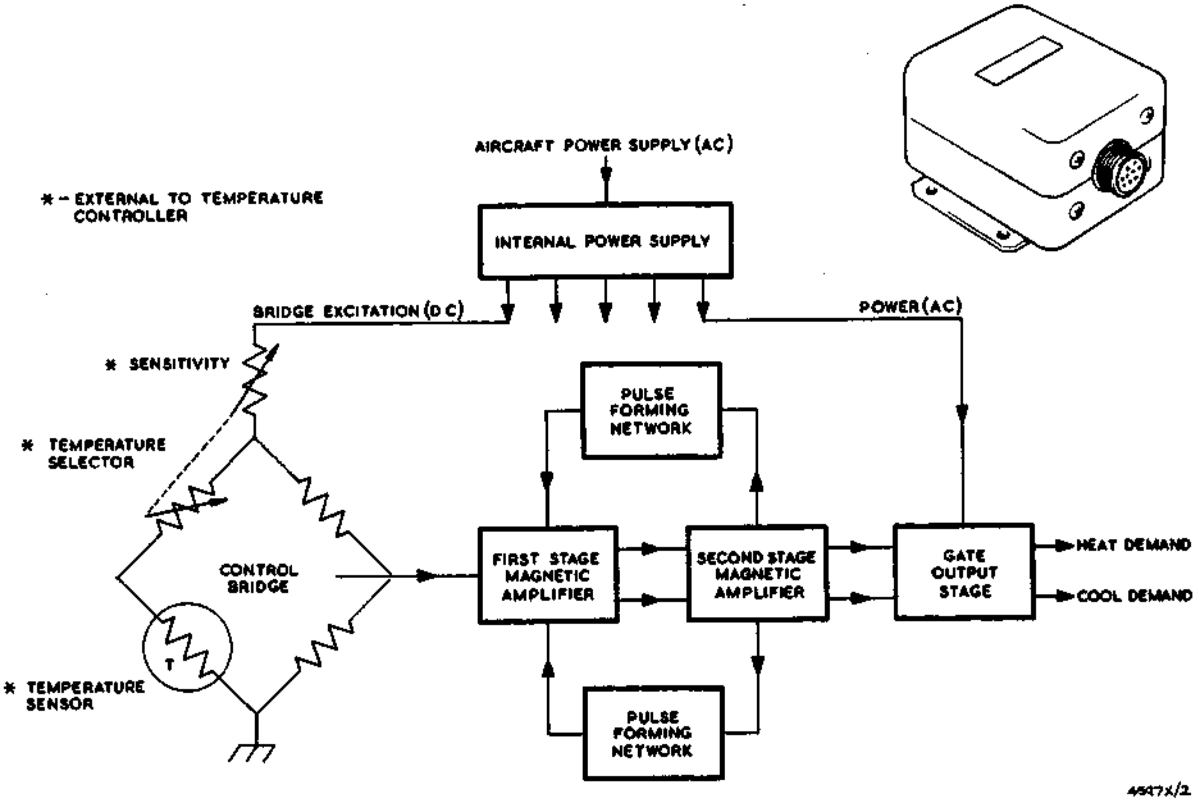
## TEMPERATURE CONTROLLER - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch temperature controller 548404 is a compact, solid state device.



Temperature Controller Schematic Diagram
Fig. 1

### 2. Operation

#### A. Bridge circuit

The sensor and selector, both remotely located, form part of the control bridge circuit. The bridge is excited by a d.c. voltage derived from the internal power supply. The sensitivity of the bridge is varied by the series rheostat ganged to the selector.

#### B. Error signal

The bridge output is applied as an error signal to the control winding(s) of the first

...Temperature controller - Description and operation continued

stage magnetic amplifier. This amplifier is a dual unit, each section responding independently depending on the direction of bridge unbalance.

### C. Amplifiers

Any error signal fed to the first stage magnetic amplifier is amplified (by the appropriate section) and then fed to the control winding(s) of the second stage magnetic amplifier. This again is a dual unit, each section responding independently.

### D. Gate output stage

The output of the second stage magnetic amplifier is fed as a trigger signal to the gate output stage. The gate output stage is also dual function, each section responding independently. The gate output stage, when triggered, feeds a.c. power from the internal power supply out of the unit as a heat demand or cool demand signal.

### E. Balanced condition

Circuit valves are such that the bridge is balanced when the sensed temperature is equal to the selected temperature. Under this condition there is no error signal fed to the amplifier, no trigger at the gate output stage, and consequently, no heat or cool demand signal fed out of the unit.

### F. Moderate unbalance

Under conditions of moderate unbalance, the appropriate section of the gate output stage will be triggered and a heat or cool demand signal fed out of the unit. However, due to the bias fed back via the pulse forming network, the trigger will be applied as a series of pulses and consequently the heat or cool demand signal will be in the form of a series of power pulses. The circuit constants are such that the duration and frequency of these pulses are in relation to the degree of unbalance. As the bridge approaches balance, and the error signal diminishes, the pulses are reduced in duration and occur of less frequent intervals, until finally, when deadband is reached, there is no power fed out at all.

### G. Extreme unbalance

Under conditions of extreme unbalance, the appropriate section of the gate output stage will remain steadily triggered, since the bias being fed back is insufficient to overcome the effect of the strong error signal. Under these conditions, continuous power is fed out of the unit.

### H. Deadband

The system is designed to maintain temperature within specified limits of the selected temperature. When the sensed temperature is within these limits, the control is quiescent. This region is called the deadband.

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...Temperature controller - Description and operation continued

## 3. Data

| | |
|---|---|
| Operating Voltage | 115V a.c. 400 c.p.s. |
| Electrical Connections : | |
| Pins A and L | Sensor input |
| Pins B and K | Selector input |
| Pins C and T | Selector input |
| Pin D | Temperature increase output |
| Pin G | Temperature decrease output |
| Pin H | 115V a.c. 400 c.p.s., input |
| Pin J | Ground |
| All Unlisted Pins | Not used |

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* * *

## TEMPERATURE CONTROLLER - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Unit fails to maintain desired temperature or operates erratically. | External components defective. | Repair or renew defective component. |
| | Electrical connection defective. | Repair connection |
| | Temperature control defective. | Renew control. |
| Unit fails to operate. | Loss of input voltage. | Repair voltage source. |
| | Electrical connection defective. | Repair connection. |
| | Temperature control defective. | Renew control. |

* * *

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## TEMPERATURE CONTROLLER - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Bench check temperature controller

Equipment required : See Fig. 201.

(1) Connect test equipment to the controller (see Fig. 201).

(2) Set R1 to 753 ohms.

(3) Set R2 to 1452 ohms.

(4) Set R3 to 2001 ohms.

(5) Apply 115 ± 0.5 volts, 400 c.p.s. power between pins H and J. Check that both lamps L1 and L2 are off.

(6) Increase R3 until lamp L2 starts pulsing. Check that R3 indicates 2023 to 2135 ohms.

(7) Continue increasing R3 until lamp L2 is full on. Check that R3 indicates 3272 to 4743 ohms.

(8) Decrease R3 until lamp L1 just starts pulsing. Check that R3 indicates 1879 to 1979 ohms.

(9) Continue decreasing R3 until lamp L1 is full on. Check that R3 indicates 925 to 1266 ohms.

(10) Disconnect test equipment from the controller.

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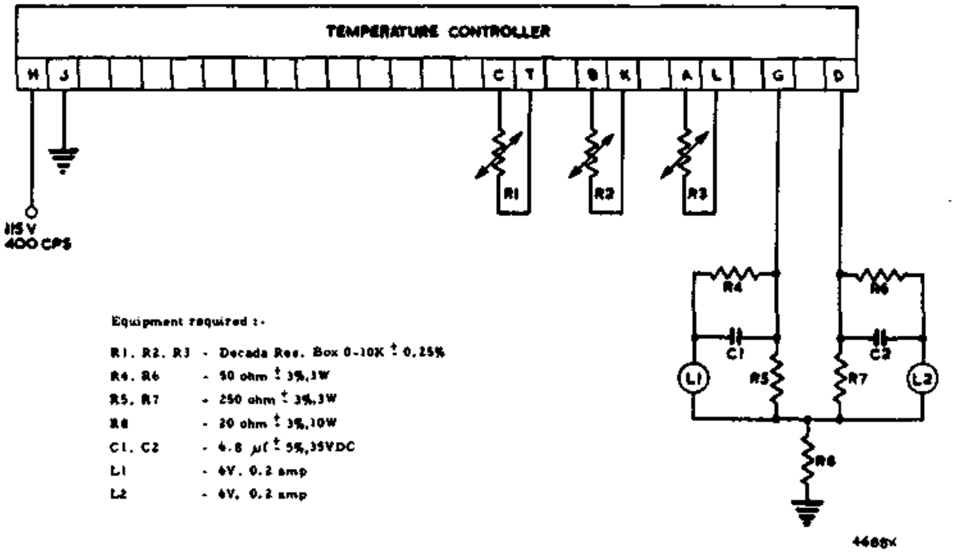

Equipment required :-

R1, R2, R3 - Decade Res. Box 0-10K ± 0.25%
R4, R6 - 50 ohm ± 3%,3W
R5, R7 - 250 ohm ± 3%,3W
R8 - 20 ohm ± 3%,10W
C1, C2 - 4.8 μf ± 5%,35VDC
L1 - 6V, 0.2 amp
L2 - 6V, 0.2 amp

Bench check equipment
Fig. 201

* * *

## TEMPERATURE CONTROL SELECTOR - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch temperature control variable resistor 548406 is a two-section, non-linear, wire wound, rheostat-connected variable resistor. Section A is nearest the shaft, and section B is at the rear. Each section has two terminals for solder connections. Refer to Table 1 for resistance over effective electrical rotation.

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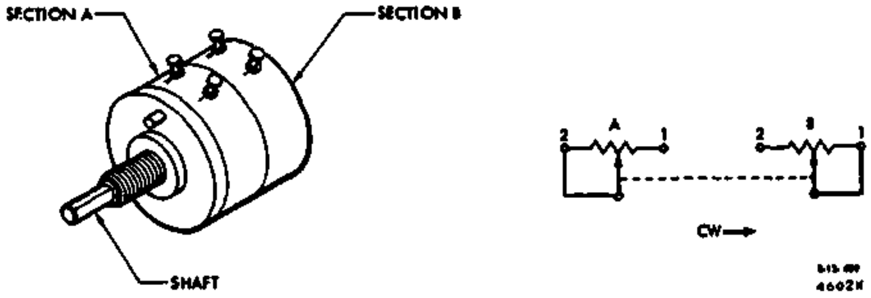

Temperature Selector
Fig. 1

Table 1

| Percentage of effective electrical rotation | Section A (Ohms) | Section B (Ohms) |
|---|---|---|
| 0 | 5000 | 434 |
| 10 | 4174 | 488 |
| 20 | 3348 | 541 |
| 30 | 2522 | 594 |
| 40 | 1886 | 647 |
| 50 | 1250 | 700 |
| 60 | 850 | 753 |
| 70 | 450 | 774 |
| 80 | 303 | 794 |
| 90 | 156 | 814 |
| 100 | 0 | 834 |

### 2. Operation

Resistance across the terminals of both sections is varied by rotating the shaft. Shaft rotation provides the resistance values listed in Table 1.

## 3. Data

| | |
|---|---|
| Total Resistance | |
| Section A | 5K ± 1% |
| Section B | 834 ohms ± 1% |
| Effective rotation | 310 ± 2 degrees |
| Effective resistance | |
| Section A | 0 to 5K |
| Section B | 434 to 834 ohms |
| Power Rating (each section) | 1.5 watts at max. resistance |
| Mechanical rotation | 320 ± 3 degrees |

* * *

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## TEMPERATURE CONTROL SELECTOR - MAINTENANCE PRACTICES

### 1. Adjustment/Test

Equipment required :-

Multimeter, Simpson, Model 260 or equivalent
Wheatstone Bridge (0 to 10000 ohms ± 25%)
Insulation Tester, Freed, Megohmmeter, Model 1620 or equivalent.

### A. Test Insulation

(1) Apply 500V d.c. between any one terminal and shaft of the unit for a period of one minute. Insulation resistance must be greater than 5 megohms.

### B. Test Resistance

(1) Using the Wheatstone bridge, measure the resistance in both sections as follows :

(a) Rotate the shaft fully anti-clockwise and check that section A (terminals close to shaft) resistance is between 4945 and 5055 ohms.

(b) Rotate shaft fully clockwise and check that section B resistance is between 825 and 843 ohms.

### C. Test Winding continuity

(1) Connect an ohmmeter between pins 1 and 2 of section A and slowly rotate the shaft from the full clockwise position to the full anti-clockwise position. The change in resistance must be smooth with no indication of jumpy or erratic readings.

(2) Repeat operation (1) with the ohmmeter connected between pins 1 and 2 of section B.

* * *

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## TURBINE BY-PASS VALVE - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch electric shut-off butterfly valve 321776 consists of an electro-mechanical rotary actuator and a butterfly valve assembly. The actuator is mounted on the valve assembly.

The actuator consists of a radio noise-free motor, magnetic brake, limit switches, gear train, linkage and output shaft. The gear shaft supports a cam which actuates the limit switches. A receptacle is provided for electrical system connection.

The valve housing serves as an air duct and is flanged at each end for installation into the system. An arrow cast as part of the housing indicates direction of airflow.

The butterfly assembly is within the valve housing. It consists of a butterfly mounted between two plates attached to a shaft. The shaft engages the output shaft of the actuator at one end and is supported on a ball bearing at the other. Position of the butterfly assembly within the duct is controlled by adjustment of a screw beneath the ball bearing.

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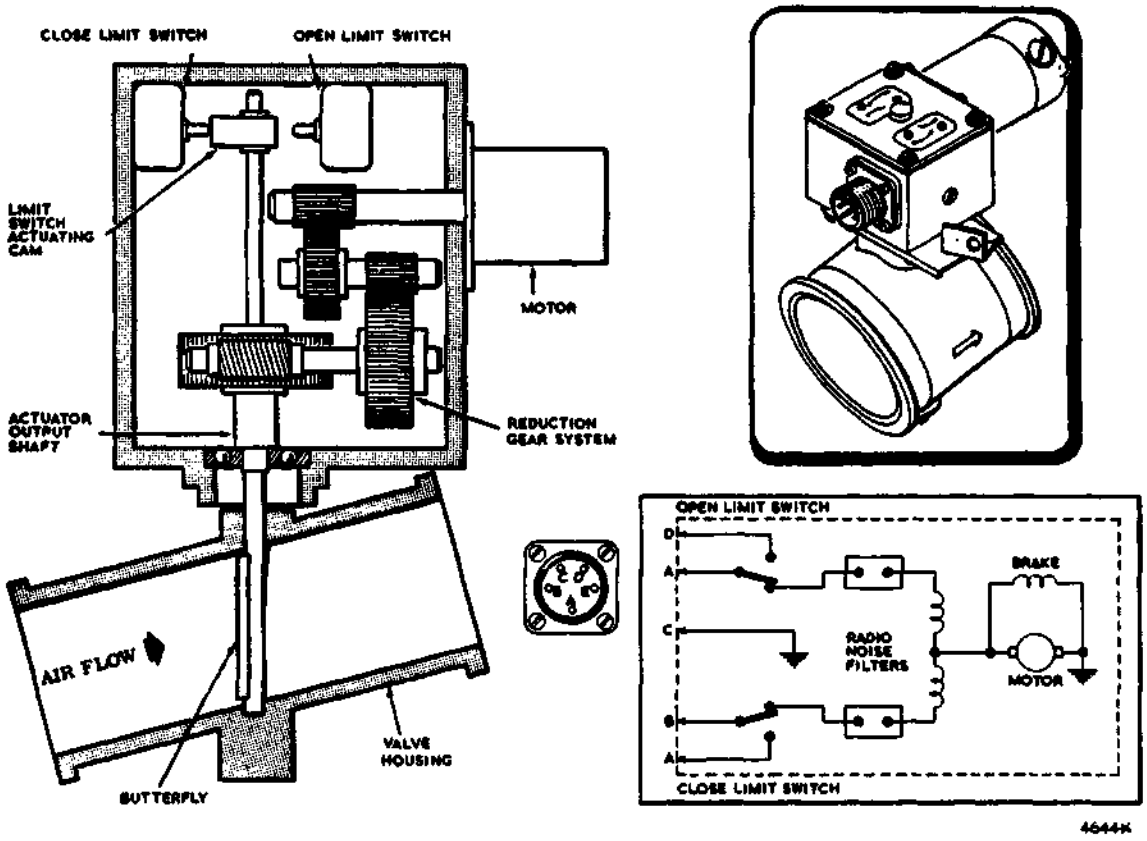


Turbine by-pass valve
Fig. 1

...Turbine by-pass valve - Description and operation continued

## 2. Operation

When the motor is energized, the output shaft of the motor drives the gear train to rotate the actuator output shaft. The rotary motion of the actuator output shaft provides a regulated movement of the butterfly in relation to actuator output shaft rotation. Butterfly movement continues until the limit switch actuating cam operates the appropriate limit switch, thereby de-energizing the motor circuit.

This unit is controlled by an external electrical circuit. When pins A and C are energized, the butterfly will move to full-open position. When pins B and C are energized, the butterfly will move to full-closed position. (See wiring diagram, Fig. 1). When the butterfly is full-open or full-closed, the appropriate limit switch is mechanically tripped, opening the motor circuit and stopping actuator travel. When the butterfly is fully open, circuit A-D is closed by the open limit switch; when the butterfly is fully closed, circuit B-E is closed. These circuits can be utilized to operate remote equipment. The limit switches are adjustable so that the butterfly travel may be limited in either direction.

Should the motor circuit be de-energized before one of the limit switches is tripped, the magnetic brake, in conjunction with the gear train, will hold the butterfly at the selected position.

## 3. Data

| | |
|---|---|
| Operating time .... .... .... | 7 to 14 seconds |
| Actuator | |
| Pin A .... .... .... | Open |
| Pin B .... .... .... | Close |
| Pin C .... .... .... | Earth |
| Pins A & D .... .... .... | Continuity exists when valve is 5 degrees from full-open to full-open |
| Pins B & E .... .... .... | Continuity exists when valve is 5 degrees from full-closed to full-closed. |
| Operating voltage .... .... .... | 26V d.c. |
| Operating current .... .... .... | 1.0 ampere (maximum) |
| Duty cycle .... .... .... | Continuous |

* * *

## TURBINE BY-PASS VALVE - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Leakage at ducting connection | Connections loose or defective | Tighten connection or renew defective component |
| Erratic or sluggish operation | Electrical connection loose or defective<br>Butterfly binding | Tighten connection or renew defective component<br>Renew unit |
| Unit operates in only one direction | Actuator defective | Renew unit |
| Unit inoperative | Electrical connection loose or defective<br>Actuator defective<br>Butterfly bound in housing | Tighten connection or renew defective component<br>Renew unit<br>Renew unit |

* * *

## TURBINE BY-PASS VALVE - MAINTENANCE PRACTICES

### 1. Removal/Installation (Fig.201)

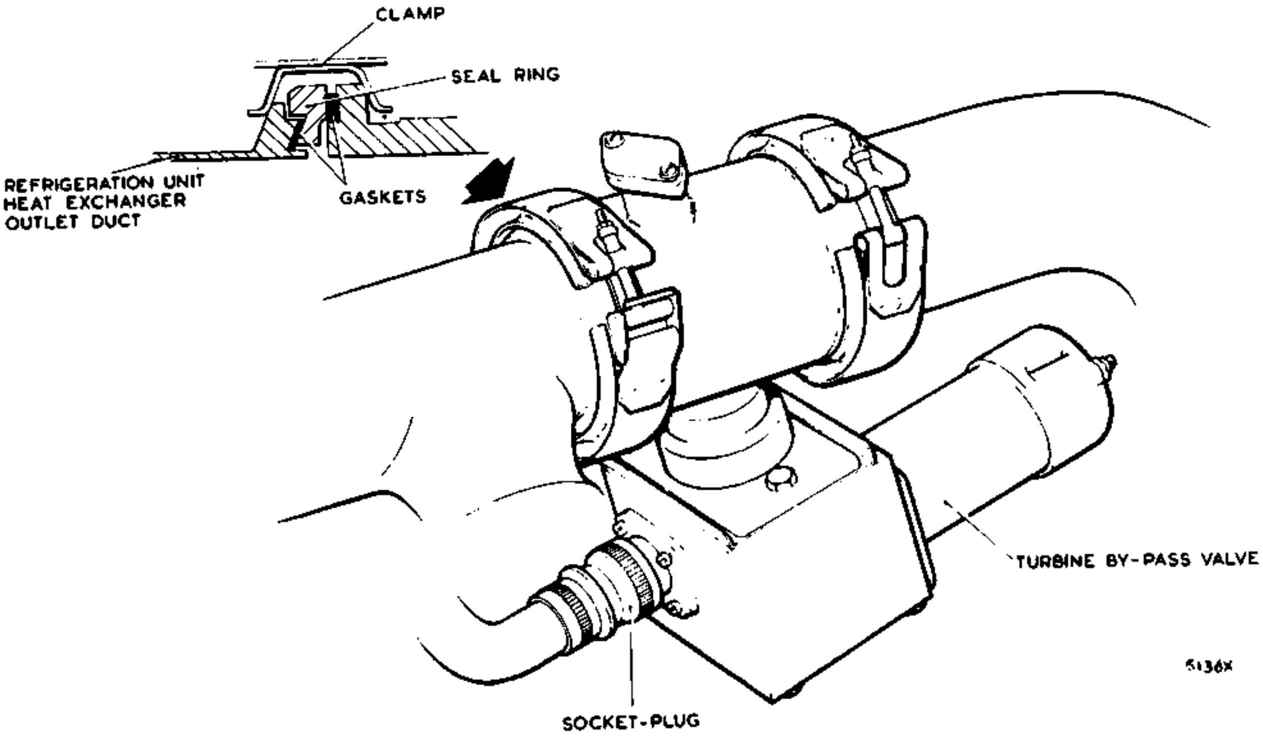
A. Remove valve

(1) On panel DA/D, trip circuit breaker CABIN TEMP CONTROL AUTO and CABIN TEMP CONTROL MANUAL (grid ref.E6 and 7), (see Chapter 24, GENERAL).

(2) Disconnect electrical cable socket plug from the valve socket.

(3) Undo clamps securing the valve to the refrigeration unit and duct; remove the valve and retain the seal ring and gaskets.

(4) Fit blanks to the valve, refrigeration unit and duct.



Turbine by-pass valve installation
Fig.201

B. Install valve

(1) Remove blanks from the valve, refrigeration unit and duct.

(2) Fit serviceable gaskets to the valve mating flanges.

(3) Position the valve so that the arrow on the valve body indicates direction of airflow, assemble the joint at the connection of the valve to the refrigeration

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...Turbine by-pass valve - Maintenance practices continued

unit as shown on Fig.201, and secure the valve to the refrigeration unit and duct using V-clamps. Torque-load clamp bolt nuts to 36-44 lb.in. Pre-mod.252180) or to 40-50 lb.in. (Mod.252180) at the refrigeration unit connection and to 45-55 lb.in. (Pre-mod.252180) or to 40-50 lb.in. (Mod.252180) at the duct connection.

(4) Connect electrical plug to the valve socket.

(5) Restore electrical circuit.

(6) Functionally test temperature control system with air supplies (see Chapter 21, TEMPERATURE CONTROL), and check remade joints, by feel of hand, for leaks.

* * *

## REFRIGERATION UNIT BY-PASS VALVE - DESCRIPTION AND OPERATION

### 1. Description

The AiResearch electric shut-off butterfly valve 104968 consists of an electro-mechanical rotary actuator and a valve housing assembly.

The actuator consists of a radio noise-free motor, friction brake, limit switches, gear system, linkage, and output shaft. The gear shaft supports a cam which actuates the limit switches. A pointer attached to the output shaft indicates, in conjunction with a plate mounted on the heat shield, the position of the butterfly. A jumper wire is provided for grounding the actuator.

The heat shield, mounted between the actuator and the valve housing assembly, protects the actuator from heat radiated by the valve housing assembly.

The valve housing assembly is a housing which serves as an air-flow duct, and a butterfly assembly. Direction of normal air flow is indicated by an arrow on the valve housing. However, air may flow in either direction; a slightly higher port leakage rate will result when air flows against the direction indicated.

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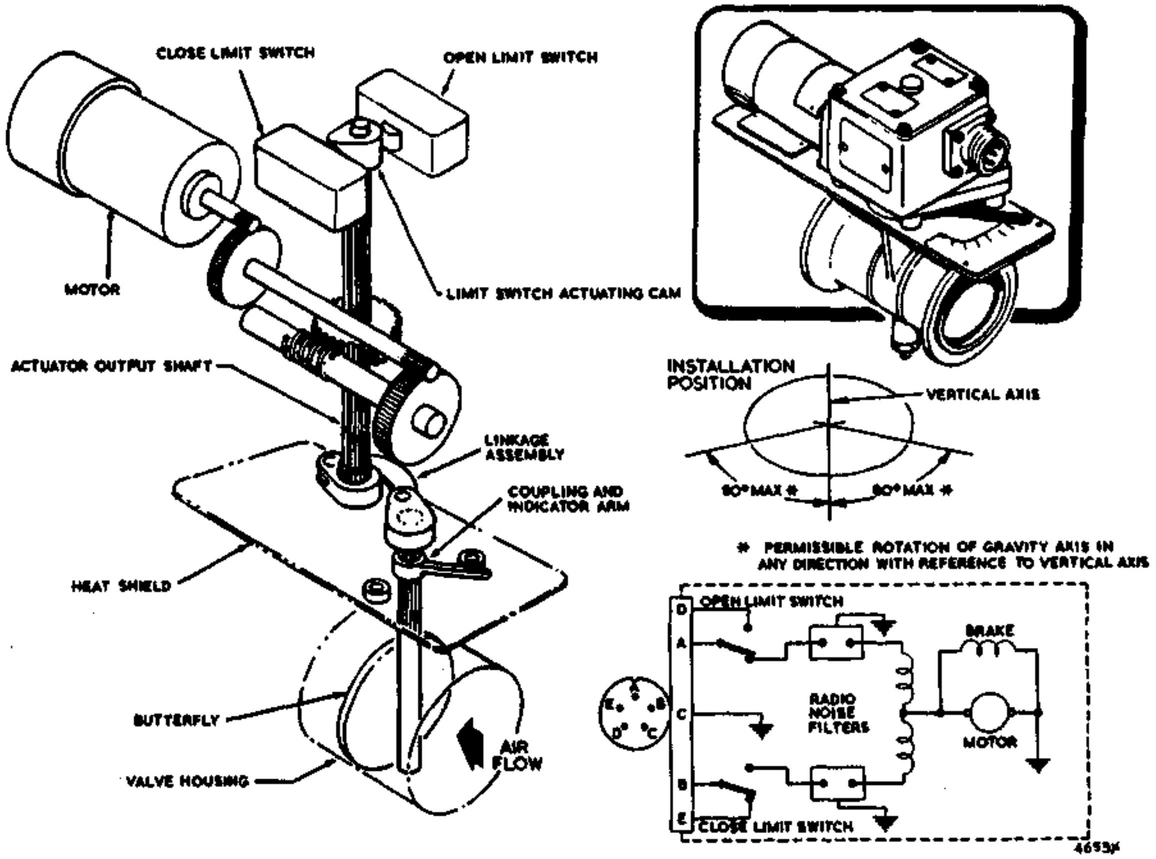

Refrigeration unit by-pass valve
Fig. 1

...Refrigeration unit by-pass valve - Description and operation continued

The top of the butterfly shaft engages the serrated linkage assembly. The butterfly rotates on a ball bearing and is positioned vertically within the duct by an adjustment screw. If the valve is installed in a position other than that shown on Fig. 1, a drain hole must be provided in the actuator.

2. Operation

This unit is controlled by an external electrical circuit and the two limit switches. When pins A and C are energized, the butterfly will move to full-open position. Air may flow through the valve in either direction. When pins B and C are energized, the butterfly will move to full-closed position. When the butterfly reaches full-open or full-closed position, the appropriate limit switch is mechanically tripped, opening the circuit and stopping actuator travel.

When the butterfly is full open, circuit AD is closed by the open limit switch; when the butterfly is full closed, circuit BE is closed. These circuits can be utilized to operate remote equipment.

Should the motor circuit be de-energized before one of the limit switches is tripped, the magnetic brake, in conjunction with the gear train, will hold the butterfly at the selected position. Circuits AC and BC will remain closed so that the butterfly may subsequently be actuated in either direction.

3. Data

| | |
|---|---|
| Operating Time .... .... | 10 to 14 seconds |
| Actuator | |
| Pin A .... .... .... | Open |
| Pin B .... .... .... | Closed |
| Pin C .... .... .... | Earth |
| Pin D .... .... .... | Energized when valve is fully open |
| Pin E .... .... .... | Energized when valve is fully closed |
| Operating Voltage .... .... | 26V d.c. |
| Operating Current .... .... | 1.0 ampere |
| Duty Cycle .... .... .... | Continuous |

* * *

## REFRIGERATION UNIT BY-PASS VALVE - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Valve leaks excessively with butterfly closed | Actuator out of adjustment<br>Valve assembly defective<br>Butterfly defective | Renew valve<br>Renew valve<br>Renew valve |
| Valve operation sluggish or erratic | Electrical connection loose or defective<br>Butterfly, linkage, or gear train binding | Tighten connection or renew defective component<br>Renew valve |
| Valve inoperative | Electrical connection loose or defective<br>Actuator defective<br>Butterfly bound in housing | Tighten connection or renew defective component<br>Renew valve<br>Renew valve. |

* * *

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# REFRIGERATION UNIT BY-PASS VALVE - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove valve

(1) On panel DA/D, trip circuit breakers CABIN TEMP CONTROL AUTO and CABIN TEMP CONTROL MANUAL (grid ref.E6 and 7), (see Chapter 24, GENERAL).

(2) Disconnect electrical cable socket-plug from the valve.

(3) Remove cable clip from the valve.

(4) Undo clamps securing valve to ducting, and remove valve and seals.

(5) Fit blanks to valve and open ducts.

### B. Install valve

(1) Remove blanks from valve and ducting.

(2) Position the valve so that the arrow on the valve body indicates direction of airflow, fit serviceable seals, and secure valve to ducting using clamps; torque-load clamp-bolt nuts to 50-60 lb in. (pre Mod. 252180) or to 40-50 lb in. (Mod.252180).

(3) Connect cable socket-plug to the valve socket.

(4) Secure cable clip to the valve.

(5) Reset circuit breakers.

(6) Functionally test temperature control system, and check remade joints for leaks.

* * *

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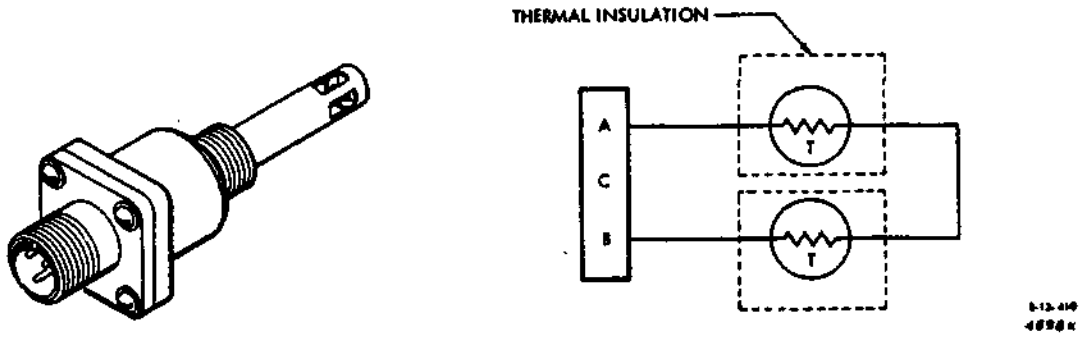
# DUCT TEMPERATURE CONTROL SENSOR - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch temperature sensor 548408 contains a sensing element, plug for holding element in proper position, shield, housing, and connector. Resin in the housing and shield provides thermal insulation for the sensing elements wire leads.



Temperature control sensor
Fig.1

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## 2. Operation

Resistance of the sensing element varies inversely with temperature changes surrounding the sensing element. Resistance of the sensing element is available at pins of the connector.

## 3. Data

Resistance :

| | |
|---|---|
| 39° to 41°F (3.89° to 5°C) | 4678 ohms |
| 76° to 78°F (24.44° to 25.56°C) | 2001 ohms |
| 119° to 121°F (48.33° to 49.44°C) | 841 ohms |

* * *

## DUCT TEMPERATURE CONTROL SENSOR - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Bench check temperature sensor

Equipment required :-

| | |
|---|---|
| Megohm Bridge .. .. | (Model 544B, General Radio Co., Cambridge, Massachusetts - or equivalent). |
| Suitable equipment for stabilizing the temperature of the sensor at 77° ± 3°F. | |
| Wheatstone Bridge (0 - 10,000 ohms ± 0.25%) | |
| Thermometer .. .. | (Type 15-155, Fisher Scientific Co., New York, N.Y. - or equivalent). |

General

The following instructions provide a means of testing the sensor with standard laboratory equipment. Methods and values used are for overhaul testing and are not intended to reflect calibration accuracy used during manufacture. Two characteristics of the sensor require observance of special precautions in testing; the change in resistance value in response to slight ambient temperature changes, and the dissipation factor (change in sensor temperature with resultant change in resistance value caused by electric current flow). To keep ambient temperature changes to a minimum, it is mandatory that testing be conducted with the aid of an insulated flask, or Thermos bottle, filled with water stabilized at temperature specified.

CAUTION : DO NOT USE ANY TYPE OF SOLVENT.

To keep error caused by the dissipation factor at a minimum, Wheatstone bridge current should not exceed 80 microamperes and excitation voltage should be applied for minimum length of time required to obtain a reading when approaching balance. The final bridge balance should be determined by a momentary application of bridge voltage.

(1) Insulation resistance check

(a) Using megohm bridge, measure resistance between each connector pin and housing.

(b) Resistance shall be greater than 5 megohms.

...Duct temperature control sensor - Maintenance practices continued

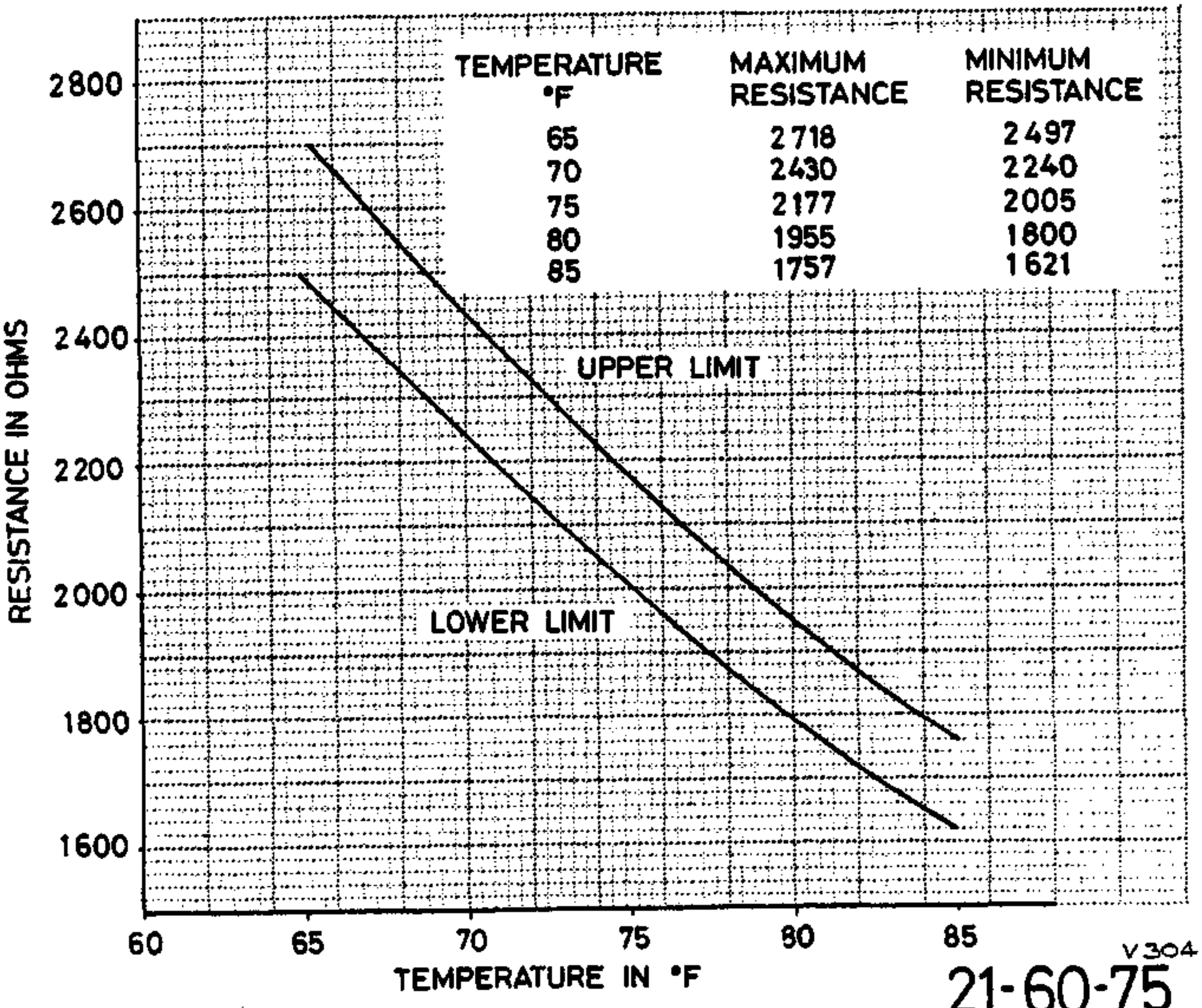
(2) Calibration checks

(a) Connect Wheatstone bridge between pins A and B of sensor connector. Suspend sensor so that thermistor beads are well-immersed in water stabilized at 77° ± 3°F in an insulated flask, being careful to keep electrical connections completely dry.

(b) Place bulb of thermometer as close as possible to tip of thermistor beads, and allow sensor and thermometer to stabilize at test temperature.

(c) Null Wheatstone bridge, using momentary applications of excitation voltage. Bridge current should not exceed 80 microamperes.

(d) Plot resistance value obtained against temperature indicated by thermometer on graph shown in Fig.201. Point obtained shall fall between UPPER LIMIT and LOWER LIMIT curves.



| TEMPERATURE °F | MAXIMUM RESISTANCE | MINIMUM RESISTANCE |
|---|---|---|
| 65 | 2718 | 2497 |
| 70 | 2430 | 2240 |
| 75 | 2177 | 2005 |
| 80 | 1955 | 1800 |
| 85 | 1757 | 1621 |

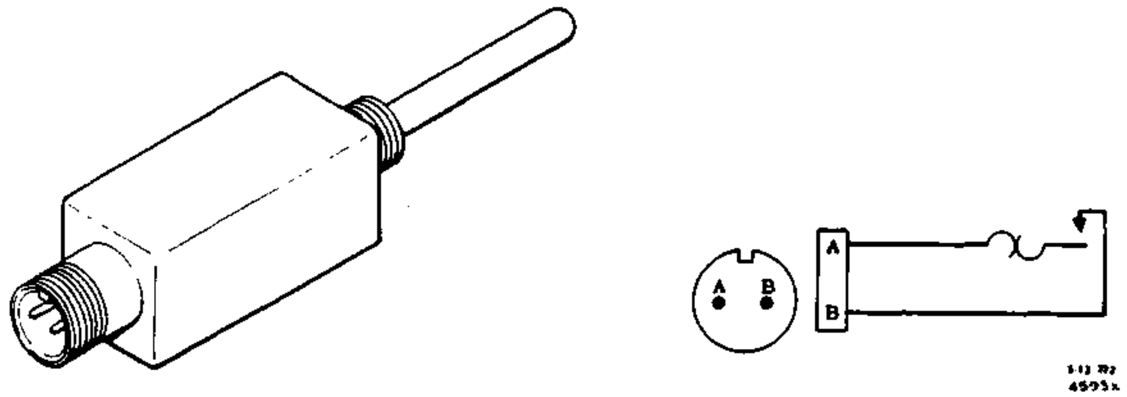
Resistance/temperature graph
Fig.201

* * *

# TEMPERATURE SWITCH - DESCRIPTION AND OPERATION

## 1. Description

The temperature switch consists of a housing which contains normally open electrical contacts and a temperature sensitive element. The housing has an electrical connector at one end and a threaded boss with a cylindrical extension at the other end.



Temperature switch
Fig.1

## 2. Operation

The thermostatic switch actuates to a closed position when air temperature exceeds the actuating temperature. When the temperature decreases to less than the actuating temperature, the thermostatic switch returns to the normally open position.

## 3. Data

Actuating temperature:-

| | |
|---|---|
| Pre-Mod.252438 and 252455 | 200° ± 10°F (93.3° ± 5.6°C) |
| Mod.252438 | 220° ± 10°F (104° ± 5.6°C) |
| Mod.253293A | 222° ± 10°F (105.6° ± 5.6°C) |
| Mod.252455 | 240° ± 10°F (115.6° ± 5.6°C) |

* * *

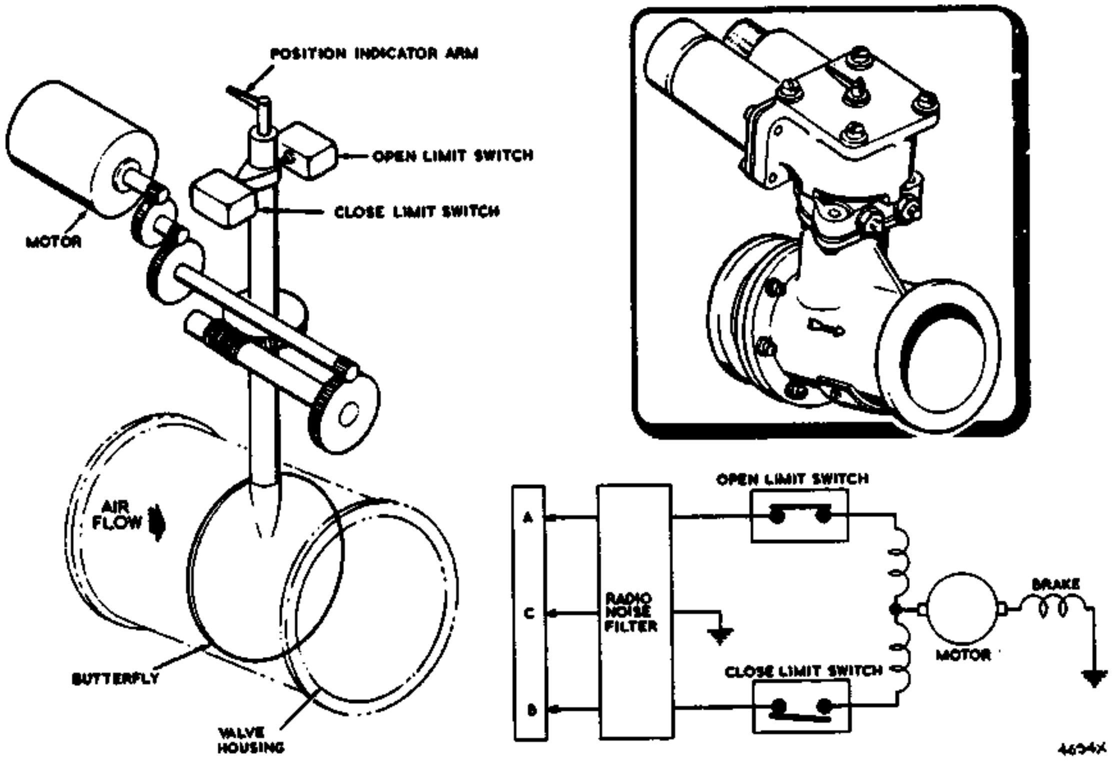
# AUXILIARY HEATING VALVE - DESCRIPTION AND OPERATION

## 1. Description

The AiResearch electric air shut off and modulating valve 104568 consists basically of an electromechanical rotary actuator and a butterfly valve assembly. The actuator is mounted on the valve assembly.

The actuator contains an electric motor which is equipped with a magnetic friction brake, a gear train, two limit switches, and an output shaft. The splined end of the motor shaft extends into the gear case to motivate the gear train, the output shaft, and the limit switch actuating cam.

The valve is made up of a spoon-valve assembly and an air-flow duct. The spoon is bearing mounted in the duct and is connected to the actuator through a gear train that operates an indicator on top of the actuator housing.



Auxiliary heating valve
Fig. 1

...Auxiliary heating valve - Description and operation continued

## 2. Operation

This unit is controlled by an external circuit and the two limit switches. When the motor is energized, the gear train is set in motion, rotating the spoon to the open or closed position. When the spoon is rotated to either extreme position, the actuating cam trips the appropriate limit switch to interrupt the electric circuit.

In addition to full rotation in either direction, the spoon can be modulated, as desired, to any position between fully open and fully closed. When the motor circuit is de-energized within the cycle of spoon rotation in either direction, and before the limit of spoon travel has been reached, the gear train, in conjunction with the magnetic friction brake, holds the butterfly at the position selected until the motor circuit is re-energized.

## 3. Data

| | |
|---|---|
| Operating Air Pressure .... | 255 psig (max.) |
| Operating Air Temperature .... | 487°C (910°F) (max.) |
| Ambient Air Temperature Range .... | -54° to 107°C (-65° to 225°F) |
| Operating Time .... .... | 7 to 13 sec. |
| Duty Cycle .... .... .... | Continuous to 93°C (200°F) ambient, 1/2 min. on, 2-1/2 min. off to 107°C (225°F) |
| Operating Current .... .... | 0.2 amp at 26V d.c. |
| Receptacle | |
| Pin A .... .... .... | Open |
| Pin B .... .... .... | Close |
| Pin C .... .... .... | Earth |

* * *

## AUXILIARY HEATING VALVE - TROUBLE SHOOTING

| Trouble | Probable cause | Remedy |
|---|---|---|
| Leakage at duct connection. | Connection loose or defective. | Tighten connection or renew defective component. |
| Unit inoperative. | Electric connection loose or defective. | Tighten connection or renew defective component. |
| | Actuator defective. | Renew unit. |
| | Shut-off valve assembly defective. | Renew unit. |
| Unit operates only in one direction. | Actuator defective. | Renew unit. |
| Unit operates in a sluggish or erratic manner. | Electric connection loose or defective. | Tighten connection or renew defective component. |
| | Butterfly binding or sticking in housing. | Renew unit. |
| | Actuator defective. | Renew unit. |
| Excessive port leakage. | Close limit switch out of adjustment. | Renew unit. |
| | Shut-off valve assembly defective. | Renew unit. |

* * *

# AUXILIARY HEATING VALVE - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove valve

(1) On panel DA/D, trip circuit breaker COCKPIT HEAT CONTROL (grid ref.E11), (see Chapter 24, GENERAL).

(2) Disconnect electrical cable socket-plug from the valve.

(3) Release clamps securing valve to ducting, and remove valve and seals.

(4) Fit blanks to valve and open ducts.

### B. Install valve

(1) Remove blanks from valve and ducting.

(2) Fit serviceable seals, and secure valve to ducting using clamps; torque-load clamp-bolt nuts to 45-55 lb in. (pre Mod.252180) or to 40-50 lb in. (Mod.252180).

(3) Connect electrical cable socket-plug to the valve socket.

(4) Reset circuit breaker.

### C. Checks/Tests after installation

(1) Start an engine and set the throttle to ground idle (see Chapter 71, GENERAL).

(2) Operate CKPT TEMP switch to INC, and check that the valve motors to the fully open position in 7 to 13 seconds.

(3) Check remade joints, by feel of hand, for leaks.

(4) Operate CKPT TEMP switch to DEC, and check that the valve motors to the fully closed position in 7 to 13 seconds.

(5) Shut down engine (see Chapter 71, GENERAL).

* * *

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# CHAPTER

# 22

# AUTO FLIGHT

## LIST OF EFFECTIVE PAGES: Chapter 22 - AUTOPILOT

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# Chapter 22

# AUTOPILOT

## 1. General

The autopilot equipment is closely integrated with the Flight Control System and navigational radio equipment. For convenience, therefore, the autopilot installation for 'B' Series aircraft is covered in Chapter 34.

'A' Series aircraft operators should refer to the appropriate agent or equipment manufacturer for system and component data.

* * *

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# CHAPTER

# 23

# COMMUNICATIONS

## Chapter 23

## COMMUNICATIONS

## TABLE OF CONTENTS

* No separate description

+ No separate maintenance practices

| | | | |
|---|---|---|---|
| + | 23-20-1622 | VHF aerial (in overfin) | 25TF 215A |
| *+ | 23-60-0 | STATIC DISCHARGING | |
| * | 23-60-11 | Static discharger probe (straight) | Chelton 2-11 |
| | | (angled) | Chelton 2-12 |
| | | Mounting base (unaltered) | Chelton 2-23 |
| | | (left-hand) | 25RF1083 |
| | | (right-hand) | 25RF1084 |
| * | 23-60-12 | Static discharger | Granger 610-1011<br>611-1008 |

Refer to appropriate agent or equipment manufacturer for system and component data.

* * *

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# VHF COMMUNICATION AERIAL - DESCRIPTION

The v.h.f. communication aerial is formed by the upper vertical stabilizer. The design is such that the relative masses, shapes and disposition of the metallic and non-metallic components behave, at radio frequencies, like a sleeved unipole aerial with top loading, and they also form the major portion of the required matching stub.

* * *

# STATIC DISCHARGE PROBE - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove discharge probe

(1) Loosen retaining screw at the rear of the probe discharger by two or three turns.

(2) Press or tap this screw to release the grip of the taper on the probe in the base. Support the base during this operation.

**CAUTION** : DO NOT ATTEMPT TO RELEASE THE PROBE DISCHARGER BY PULLING ON THE ROD.

(3) With the taper grip released, remove the retaining screw completely and remove probe discharger.

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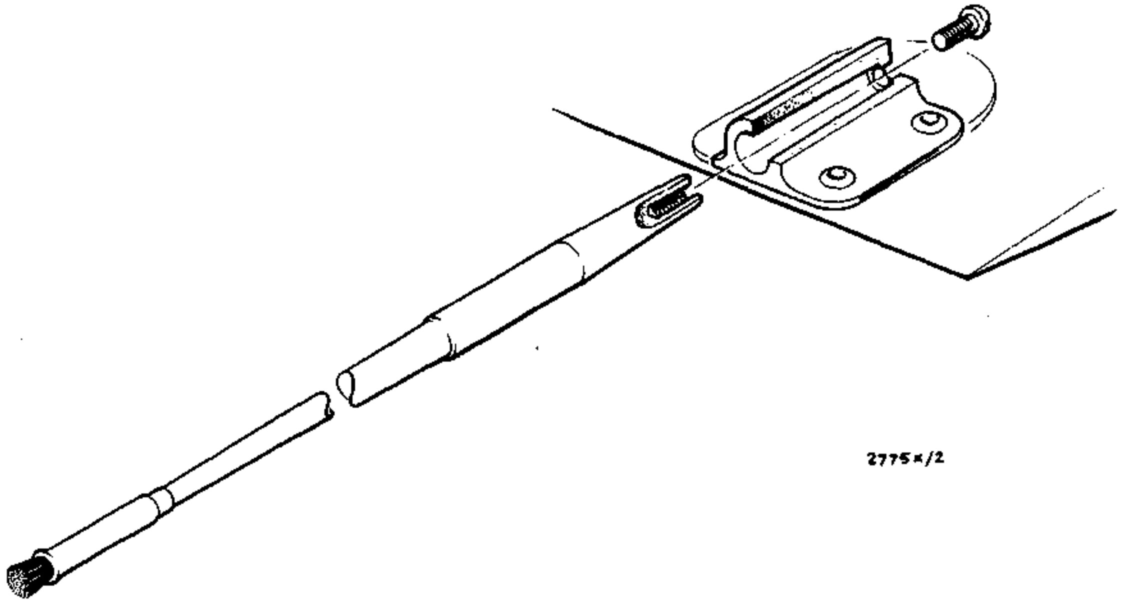
### B. Install discharge probe

(1) Remove the round-head screw from the end of the probe discharger.

(2) Plug probe discharger lightly into base and engage retaining screw by a few turns.

(3) Push probe discharger firmly home into base by finger pressure on the thick end of the tapered sleeve.

**CAUTION** : DO NOT ATTEMPT TO PUSH THE PROBE DISCHARGER INTO ITS SOCKET BY PRESSURE ON THE ROD OR TIP.



Static discharge probe
Fig.201.

...Static discharge probe - Maintenance practices continued

(4) Tighten round-head screw to closure, plus a further two full turns to pull the taper sleeve into tight engagement.

## 2. Adjustment/Test

### A. Test resistance of discharge probe

(1) Connect a 500 volt Megger between the fixing base sleeve and the wire tuft.

CAUTION : DO NOT DAMAGE TUFT DURING CONNECTION OF A TEST CLIP.

(2) Check resistance of rod is between 7 and 80 megohms (Types 2-11, 2-11-S and 2-12) or 5 and 60 megohms (Type 2-18-S).

(3) Disconnect Megger.

### B. Test bonding of discharge probe

(1) Using a suitable test set, check that resistance between sleeve on base assembly and aircraft skin adjacent to base assembly does not exceed 0.05 ohm.

## 3. Inspection/Check

### A. Wire tuft check

(1) Check that each discharge probe has not more than 50% of wire tufts missing and a minimum tuft length of 1/16 in. (1.6 mm).

* * *

# STATIC DISCHARGER - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove discharger

Equipment required : Splined Key (Granger)

(1) Loosen retaining screw at base of discharger by two or three turns.

(2) Remove discharger from the base.

CAUTION : DO NOT USE THE DISCHARGER ROD TO ASSIST REMOVAL.

### B. Install discharger

(1) Fit discharger into base and engage and tighten securing screw.

CAUTION : DO NOT APPLY PRESSURE TO THE DISCHARGER ROD TO ASSIST INSTALLATION.

## 2. Adjustment/Test

### A. Test Resistance of discharger

(1) Connect a 500 volt Megger between the fixing base and one of the discharge pins.

CAUTION : DO NOT DAMAGE DISCHARGER POINTS DURING CONNECTION OF A TEST CLIP.

(2) Check resistance of discharger.

TABLE 1

| Type | Resistance tolerance |
|---|---|
| 610-1011 or 610D-1B | 8-100 Megohms |
| 611-1008 or 611D-1B | 5-60 Megohms |

(3) Disconnect megger.

### B. Test bonding of discharger.

(1) Using a suitable test set, check that the resistance between base assembly and adjacent aircraft skin does not exceed 0.05 ohm.

* * *

# CHAPTER

# 24

# ELECTRICAL POWER

## Chapter 24

## ELECTRICAL POWER

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Isolating circuits and general precautions for unit removal/installation.
Rendering aircraft safe after removal of electrical equipment.
Use of ground supplies, auxiliary power unit and aircraft batteries.
Bonding.
Earth path impedance tests.
Inspection of earth station assemblies.
Torque loading of electrical connections.
Pressure bungs.
Diode testing.

24-21-16 CONSTANT FREQUENCY SYSTEM
* 24-21-101 Inverter - Jet Electronics S1-2500B
Inverter - Flite-tronics PC15BC
Switch, inverter start/stop - Lucas LHA1 BG214
Switch, standby inverter arm/off - Lucas LHA1 BG205
Contactor - Lucas LDA200B18C
Relay, inverter output - Leach 9274-4024
Relay, standby inverter input supply - Leach 9330-4026
Relay, XS1 fail - Leach 9274-4025
Relay, XS2 and XE fail - Leach 9330-4027
Inverter output protection unit - HSD B00-E6-00443A (Pre-mod.25/2628)
Inverter output protection unit - Hartman E-308Y (Mod.25/2628)

24-22-03 RANDOM FREQUENCY WINDSHIELD POWER SYSTEM
* 24-22-21 AC generator - Lucas BA00501C
- Lucas BA00501-1 (Mod.252831)
Generator control unit - Lucas CB005-01C
Contactor - Hartman N210S
Control switch - Honeywell 1TL1-3
Relay - Leach M400-D-4-A
Microswitch - Honeywell 1EN1-14N119

24-30-04 DC GENERATION (Without cold start and 3rd battery)
24-30-21 Starter/generator - Lear Siegler 23076-005
Ground fault transformer - Lear Siegler GC-66
Series battery auxiliary relay - Leach M300-D-4-A
Generator control unit - Lear Siegler 51509-006
Generator line contactor - Hartman A703S
Generator control switch - Lucas LHA2 BG104

...Contents continued

Generator control relay - Leach 596/TS/1688/1
Generator shunt - Datek 1626
Battery shunt - Datek 1628
D.c. ammeter - Sangamo Weston S546/3/50
Ammeter relays - Hellerman Deutsch HDS 8S-F2-L06
Ammeter scaling resistors - Welwyn 4033Z 453Ω ±1% 1/4W
Ammeter battery push switches - Controls USA WC1503
D.c. voltmeter - Sangamo Weston S149/3/274
D.c. voltmeter selector switch - Lucas LHA2 BG201
Battery contactor - Hartman A700 RMS
24-30-102 Battery 24V 25Ah - Chloride Industrial Batteries EDQ/F3 (Pre-mod.257488)
24-30-102 Battery 24V 25Ah - Chloride Industrial Batteries PEDQ/F3 (Mod.257488)
24-30-103 Battery 24V 25Ah - Hawker lead acid type 9750E0640
24-30-104 Battery 24V 23Ah - SAFT nickel-cadmium type 23491 (Alternative to EDQ/F3 or PEDQ/F3)
* 24-30-105 Battery thermostat
Battery switch - Honeywell 4TL1-10L
Emergency contactor - Hartman N419S
Bustie switch - Honeywell 2TL1-70
Bustie contactor - Lucas LDA-150-A8C
Bustie auxialiary relay - Leach M300-D-4-A
* 24-30-142 Bustie protection unit - Lucas U3626
Ground power contactors - Lucas LDG 150-Y4
Ground power switch - Lucas LHA2 BG206 AEI
Ground power plug - Cannon GCB-3LV-14-GB-183
Socket (relay M300) - Leach 50-1049-8309
Socket (relay HDS 8S) - Hellerman Deutsch 420204
Diodes (power) - Westinghouse S2EN-200U-1008
Diodes (control) - Mullard BXY5260 and RCSC CV7313
Circuit breakers - Klixon D7271, D7274 and 6TC14
Fuses (busbar feeder) - English Electric and Belling Lee
Fuses (circuits) - Interservice

24-35-03 APU GENERATION
24-30-21 Starter/generator - Lear Siegler 23076-005
Ground fault transformer - Lear Siegler GC-66
Generator control unit - Lear Siegler 51509-006
Generator line contactor - Hartman A703S
Generator control switch - Lucas LHA2 BG104
Generator control relay - Leach M300-D-4-A
Generator fail indicator - Dowty 1245Z Mk38
Oleo relay - Hellerman Deutsch HDD 4S-F2-H06
Auxiliary ground power relay - Leach M300-D-4-A
No.2 g.l.c auxiliary relay - Hellerman Deutsch HDS 8S-F3-J06
Generator ammeter - Sangamo Weston S546-3-50
Field resistor - Berco RAH-K3-4-3 (4.3Ω 50W)

+ 24-50-00 DISTRIBUTION

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# ELECTRICAL POWER - MAINTENANCE PRACTICES

## 1. General

CAUTION : BEFORE INSTALLATION OF ANY ELECTRICAL EQUIPMENT, ENSURE THAT ALL TRANSPORTATION/PROTECTIVE BLANKS AND PACKAGING IS REMOVED.

### A. Isolating circuits prior to removal of electrical power panels and units

(1) To eliminate the possibility of damage to equipment or the aircraft structure by shorting live terminals to earth, before removing electrical power or control panels, or disconnecting electrical leads from units located thereon, ensure that all electrical power is off by disconnecting ground supplies and the aircraft batteries.

Prominently display notices adjacent to the ground supply plugs and batteries stating that electrical power sources are not to be connected.

NOTE: When battery leads are disconnected, they should be stowed to prevent damage or distortion.

(2) Before removing electrical units remote from power and control panels, render the circuit inoperative by removing or tripping the relevant fuse or circuit breaker.

Stick a notice over the fuseholder or circuit breaker stating that the fuse should not be refitted or the circuit breaker reset.

### B. Rendering aircraft safe after removal of electrical equipment

(1) After removal of electrical components, and where substitutes are not readily available, ensure that the aircraft is safe electrically, as outlined in para.1.(2), before re-connecting electrical supplies to permit operation of the aircraft services during ground servicing.

### C. Use of ground supplies, auxilliary power unit (APU) and aircraft batteries

NOTE : To avoid drain on the aircraft batteries, it is recommended that testing of electrical services be carried out using ground supplies. Use of the batteries should be severely restricted during servicing.

(1) To energize d.c. busbars from ground supplies or the APU proceed as shown on Fig.201.

## 2. Bonding

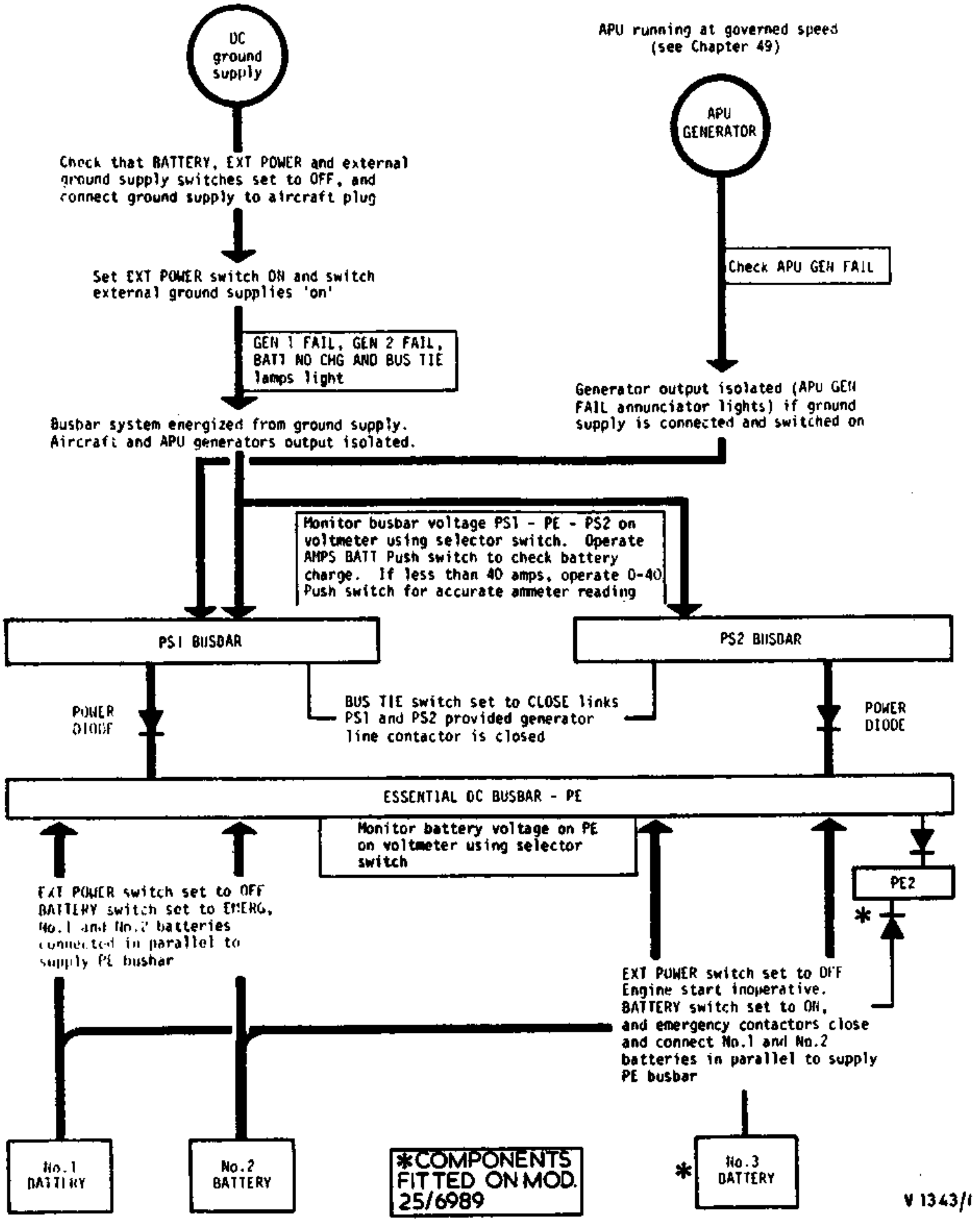
The aircraft metallic airframe structures are connected or bonded together between extremities, and thus form a homogeneous ground for all metallic surfaces (including pipelines) inside and outside the aircraft. All parts of the aircraft are therefore at the same potential and serve the following purposes:-

prevent the possibility of shock hazard to flight personnel and passengers.

ensure satisfactory radio systems performance.

satisfactory operation and performance of certain electrical equipment, e.g. radio suppression etc.

provide a low impedance path to dissipate lightning strikes.


DC ground supply
Check that BATTERY, EXT POWER and external ground supply switches set to OFF, and connect ground supply to aircraft plug
Set EXT POWER switch ON and switch external ground supplies 'on'
GEN 1 FAIL, GEN 2 FAIL, BATT NO CHG AND BUS TIE lamps light
Busbar system energized from ground supply. Aircraft and APU generators output isolated.
APU running at governed speed (see Chapter 49)
APU GENERATOR
Check APU GEN FAIL
Generator output isolated (APU GEN FAIL annunciator lights) if ground supply is connected and switched on
Monitor busbar voltage PS1 - PE - PS2 on voltmeter using selector switch. Operate AMPS BATT Push switch to check battery charge. If less than 40 amps, operate 0-40 Push switch for accurate ammeter reading
PS1 BUSBAR
PS2 BUSBAR
POWER DIODE
BUS TIE switch set to CLOSE links PS1 and PS2 provided generator line contactor is closed
POWER DIODE
ESSENTIAL DC BUSBAR - PE
Monitor battery voltage on PE on voltmeter using selector switch
PE2
*
EXT POWER switch set to OFF BATTERY switch set to EMERG, No.1 and No.2 batteries connected in parallel to supply PE busbar
EXT POWER switch set to OFF Engine start inoperative. BATTERY switch set to ON, and emergency contactors close and connect No.1 and No.2 batteries in parallel to supply PE busbar
No.1 BATTERY
No.2 BATTERY
*COMPONENTS FITTED ON MOD. 25/6989
* No.3 BATTERY
V 1343/I

DC busbar energization

Fig.201

## TABLE 201

## Bonding requirements

| Bonded areas | Maximum resistance | Remarks |
|---|---|---|
| Fuselage<br>Tail unit<br>Engine pod cowlings | 0.05 ohm | Bonding satisfied by structural assembly methods. No need for bonding unless to satisfy a specific problem, or where extensive use is made of adhesion techniques. |
| Nose and main gear<br>Ailerons and tabs<br>Airbrakes<br>Flaps<br>Rudder<br>Elevator | 0.05 ohm | see 20-20-645 para.2.A. |
| Flying control cables in :- Fuselage, wing, tailplane and fin | 1 ohm | see 20-20-645 para.2.B. |
| Piping systems in fuselage, and main landing gear :- Hydraulic, de-icing, oxygen, air, fuel and oil | 1 ohm | see 20-20-645 para.2.B. |
| Major items of installation :- Pedestal, seat rails equipment panels etc. | 0.05 ohm | see 20-20-645 para.2.A. |
| Other piping (toilet) systems | 0.5 megohms | see 20-20-645 para.3.A. |
| Components or metallic parts in contact with inflammable fluids (e.g. fuel) and equipment mounted on anti-vibration mounts | 1 ohm | see 20-20-645 para.2.B. |
| Wing root fairings<br>Furnishings<br>Control Column<br>Rudder pedals | 0.5 megohms | Bonding requirements for isolated exposed areas of metal greater than 9 inches square and all outside metallic parts of the aircraft to primary structures (see 20-20-645 para.3). |
| Static discharge wicks | 0.05 ohm | For any special instructions refer to Chapter 23, also see 20-20-645 para.2.A. |
| Lightning diverter strips<br>Radome/fuselage | 0.008 ohm | see 20-20-645 para.4. |
| R.F. Bonding | 0.0025 ohm | Resistance of individual items of equipment to be generally better than 0.0025 ohm, but specific applications may call for lower figures. |
|  |  |  |
| Engine installation<br>Engine piping installation | 0.05 ohm | see 20-20-645 para.2.A. |
| Strobe light assemblies | 0.05 ohm | see 20-20-645 para.2.A. |

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Accomplishment of bonding checks will be found in the relevant Maintenance Practices, otherwise the requirements in general are listed on Table 1. Where a suitable bonding test meter is utilised, wing 'resistivity' bonding checks should be measured against earth station *3. Earth station *3 (including all other bonded areas) should be measured against earth station *2 (see Fig.202).

## 3. Earth path impedance tests

Equipment required :-

| | |
|---|---|
| Test set .. .. .. .. | HSA TS216E, or locally manufactured equivalent |

### A. Check earth path impedance using TS216E Test set

(1) Isolate electrical supplies as follows :-

(a) Trip all circuit breakers.

(b) Select all switches off.

(c) Disconnect No.1 and 2 batteries and No.3 battery when fitted.

(2) Connect test set supply cable to a 230-250 volts a.c., 50Hz ground supply.

(3) Connect test set cable with an open-ended tag to the aircraft datum earth station No.2 (see Fig.202) and the test cable fitted with a probe to the earth station under test.

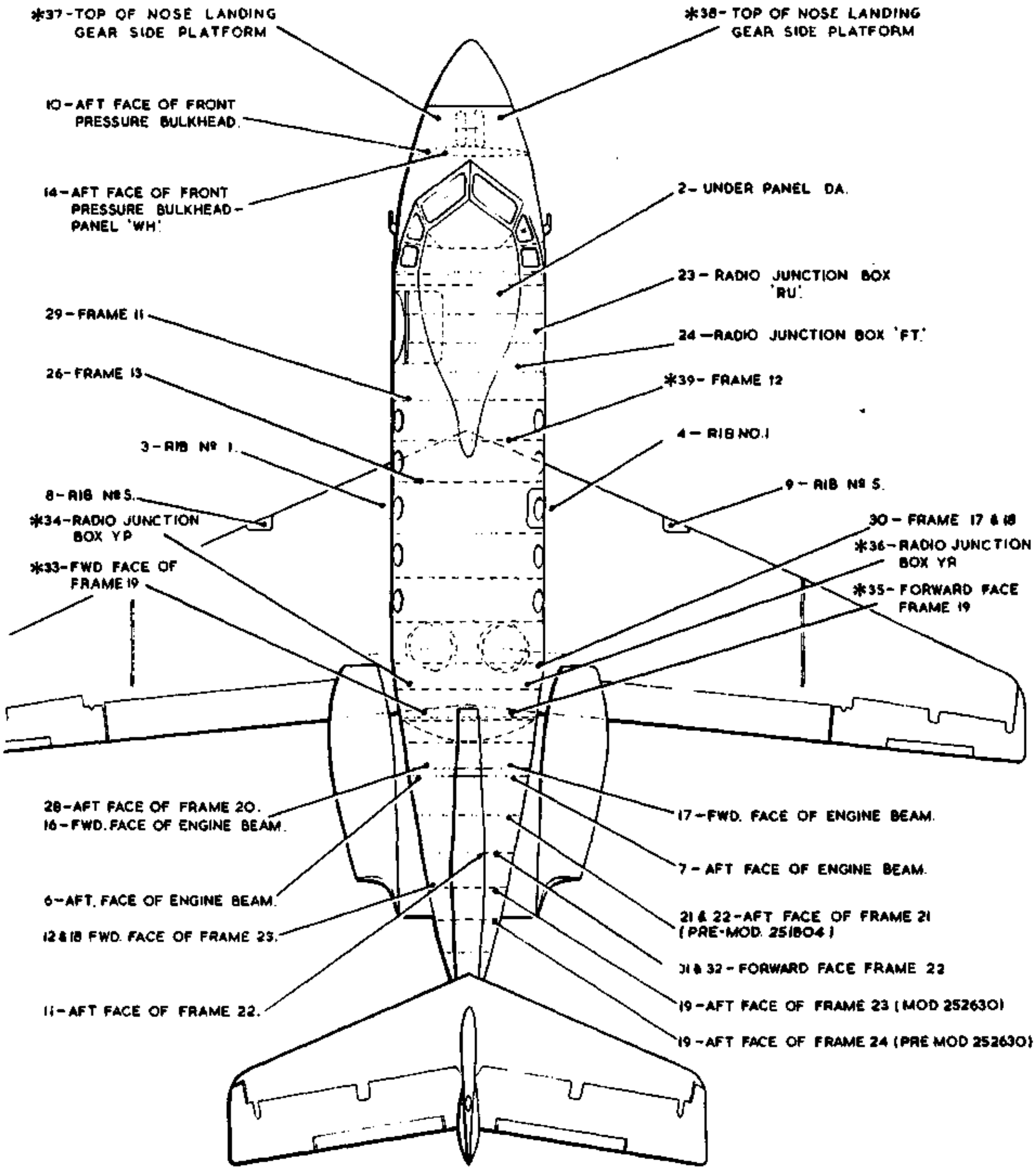
(4) Switch on a.c. ground supply, adjust test set potentiometer to apply a load of 10 amps and check that test set millivoltmeter reading does not exceed the appropriate values listed in Table 202.

TABLE 202

| Measured between earth station No.2 and :- | Millivolt reading | Equivalent milliohm reading |
|---|---|---|
| Wing earth stations | 15 | 1.5 |
| Fuselage earth stations No.10 and No.14 | 10 | 1.0 |
| All other earth stations | 3.5 | 0.35 |

NOTE : Take measurements at base plate.

(5) After checks are completed, switch off a.c. ground supply and disconnect test set cables.


*37-TOP OF NOSE LANDING GEAR SIDE PLATFORM
*38-TOP OF NOSE LANDING GEAR SIDE PLATFORM
10-AFT FACE OF FRONT PRESSURE BULKHEAD.
14-AFT FACE OF FRONT PRESSURE BULKHEAD-PANEL 'WH'.
2-UNDER PANEL DA.
23-RADIO JUNCTION BOX 'RU'.
29-FRAME 11
24-RADIO JUNCTION BOX 'FT.'
26-FRAME 13
*39-FRAME 12
3-RIB Nº 1.
4-RIB NO.1
8-RIB Nº 5.
9-RIB Nº 5.
*34-RADIO JUNCTION BOX YP
30-FRAME 17 & 18
*36-RADIO JUNCTION BOX YR
*33-FWD FACE OF FRAME 19
*35-FORWARD FACE FRAME 19
28-AFT FACE OF FRAME 20.
16-FWD. FACE OF ENGINE BEAM.
17-FWD. FACE OF ENGINE BEAM.
7-AFT FACE OF ENGINE BEAM.
6-AFT. FACE OF ENGINE BEAM.
21 & 22-AFT FACE OF FRAME 21 (PRE-MOD. 251804)
12 & 18 FWD. FACE OF FRAME 23.
31 & 32-FORWARD FACE FRAME 22
11-AFT FACE OF FRAME 22.
19-AFT FACE OF FRAME 23 (MOD 252630)
19-AFT FACE OF FRAME 24 (PRE MOD 252630)
1715/3

NOTE
EARTH STATIONS DENOTED THUS * ARE FITTED ON FLIGHT INSPECTION AIRCRAFT ONLY

Earth stations
Fig.202

(6) Connect and secure electrical connectors to batteries.

(7) Reset circuit breakers.

(8) Functionally test battery supply circuits.

B. Check earth path impedance using locally manufactured equipment (Fig.203)

(1) Isolate electrical supplies :-

(a) Trip all circuit breakers.

(b) Select all switches off.

(c) Disconnect No.1 and 2 batteries and, when fitted, No.3 battery.

(2) Connect test equipment open-ended tag to aircraft datum earth station No.2 (Fig.202) and test equipment probe to earth station under test.

(3) Operate switch A and adjust potentiometer until ammeter indicates 10 amps.

(4) Maintain switch A depressed, operate switch B and check test circuit millivoltmeter reading does not exceed the appropriate values listed in Table 202.

CAUTION : SWITCH 'B' SHOULD NEVER BE OPERATED UNLESS BOTH TEST CABLES ARE CONNECTED TO EARTH STATIONS.

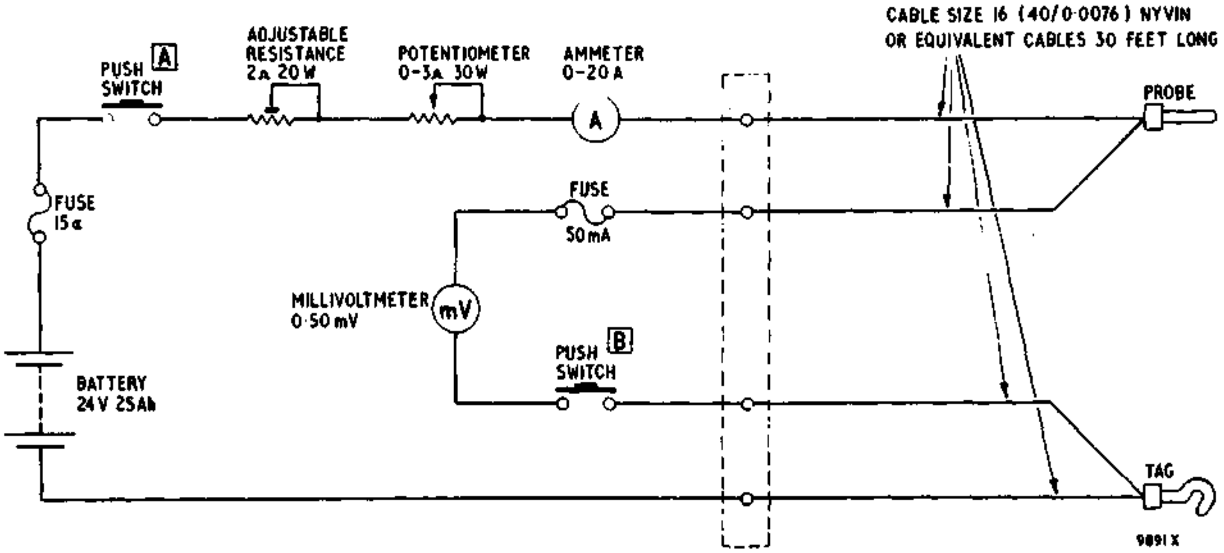
(5) Release both switches and disconnect test cables.

(6) Connect and secure electrical connectors to batteries.

(7) Reset circuit breakers.

(8) Functionally test battery supply circuits.

Fig.203 on following page



INITIAL SETTING-UP OF TEST CIRCUIT RESISTANCE :-

The total resistance of the circuit, with potentiometer resistance 'all out', should be adjusted to 1.47 ohms by means of the adjustable resistance.

NOTE : The ohmic values of the adjustable resistance and the potentiometer are valid for a 24 volt supply and would need to be altered for other supply voltages.

Earth path impedance test circuit
Fig.203

### C. Inspection of earth station assemblies

All earth station assemblies should be regularly examined for corrosion and signs of overheating. The location of earth stations is shown on Fig.202 and typical earth station assemblies are illustrated on Fig.204.

Before checking earth station assemblies ensure that all electrical supplies are isolated as follows :-

(a) Trip all circuit breakers.

(b) Select all switches off.

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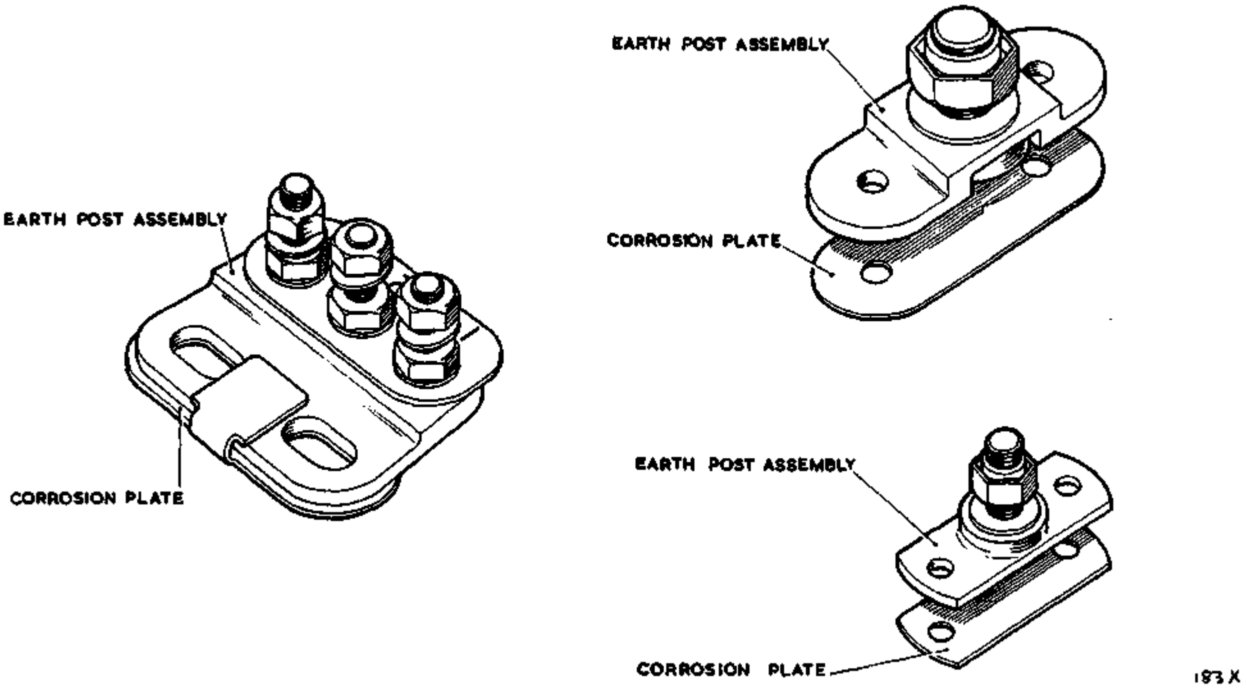

Typical earth station assemblies
Fig.204

(c) Disconnect No.1 and 2 batteries and No.3 battery when fitted.

Earth station assemblies should be checked as follows :-

(1) Remove electrical connection(s).

(2) Remove bolts securing earth terminal assembly and corrosion washer to structure.

(3) Examine mating surfaces for cleanliness and signs of corrosion. Clean as necessary, using aluminium wool, to leave all mating surfaces bright and clean and clear of Thiokol.

(4) Re-assemble corrosion washer and earth terminal assembly as soon as possible after inspection.

(5) After assembly, treat any bared area protruding beyond the mating surface, using the appropriate paint "touch-up" scheme for the area concerned.

(6) Apply Thiokol PR1422 BT2 around the mating surfaces which have been bared and also over fixing bolts and nuts in order to seal off completely the mating surfaces from ambient conditions.

(7) Check earth path impedance as detailed in para.3.A. or 3.B.

(8) Refit electrical connection(s).

On aircraft, Pre-mod.25/1492, the ground supply plug negative terminal is connected to frame 8 via a busbar link, Part No.25NF2721AB, and via a busbar link, Part No.25NF2937A, connected between frame 8 and the inboard seat rail. The busbar links connections should be checked as follows :-

(1) Remove nut and washer securing busbar link to negative terminal of ground supply plug and remove bolt, corrosion washer, washer and nut securing the link to the ground supply receptacle.

(2) Remove bolt, washer, corrosion washer and nut securing busbar links to frame 8.

(3) Remove bolt, washer, corrosion washer and nut securing busbar link to the inboard seat rail.

(4) Examine mating surfaces on the busbar links, at the ground supply receptacle, frame 8 and the inboard seat rail for cleanliness and signs of corrosion. Clean as necessary, using aluminium wool, to leave all mating surfaces bright and clean and clear of Thiokol.

(5) Re-assemble busbar links to the inboard seat rail, frame 8, the ground supply plug negative terminal and ground supply receptacle as soon as possible after inspection.

(6) After assembly, treat any bared area protruding beyond the mating surface, using the appropriate paint "touch up" scheme for the area concerned.

(7) Apply Thiokol PR1422 BT2 around the mating surfaces which have been bared and also over fixing bolts and nuts in order to seal off completely the mating surfaces from ambient conditions.

(8) Check earth path impedance as detailed in para.3A or 3B.

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(9) On completion of all earth station checks connect and secure electrical connectors to batteries, reset circuit breakers and functionally test battery supply circuits.

## 4. Torque loading of electrical connections

### A. General

A pre-determined torque load is applied to nuts and bolts securing electrical connections, to prevent overstressing and provide optimum security for electrical connections.

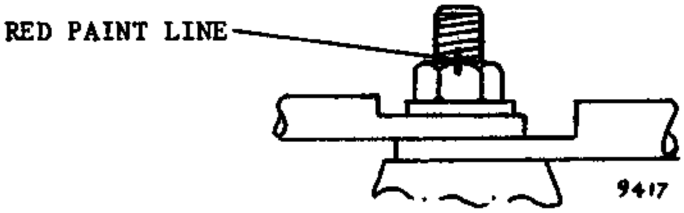
During installation of electrical assemblies, bolts or nuts securing electrical connections must be torque-tightened to a standard load for a bolt or nut and thread size, or alternatively, to a special load for a particular application as specified in the relevant maintenance practices.

Standard torque loading figures are as follows :-

0.25 in. = 50 lb.in. )
0.3125 in. = 70 lb.in. ) - 0 + 25%
0.375 in. = 100 lb.in. )

CAUTION: FAILURE TO CARRY OUT CORRECT TORQUE LOADING MAY CAUSE DAMAGE TO THREADS WHICH MAY NOT BE OBVIOUS AT THE TIME BUT CAN CAUSE FAILURE OF CONNECTION DURING SERVICE.

TO ENSURE A SATISFACTORY CONNECTION AFTER TORQUE LOADING, CHECK THAT CABLE LUGS ARE SECURELY CLAMPED AND CANNOT BE MOVED.



Typical torque loaded connection with identification marking
Fig.205

Torque loaded connections are identified by a spot or line of red paint from the thread to nut. Under no circumstances must the whole thread or nut be painted over, as this can cause seizure of the joint and prevent disconnection.

For nut and bolt connections smaller than 0.25 in., the torque loading will be as shown on Table 203, but paint identification marking is not used. All other connections not specified will be tightened in accordance with general workshop practice.

...Electrical power - Maintenance practices continued

## B. Components

Main contacts of the following components are to be torque loaded to values given. Ensure that all cable lugs and washers are bottomed and perfectly flat and that the whole assembly is hard down on stud base.

| | |
|---|---|
| Inverter contactor .. .. .. | 60/70 lb in. |
| Ground contactor .. .. .. | 60/70 lb in. |
| Start contactor .. .. .. | 115/130 lb in. |
| Generator line contactor .. .. | 115/130 lb in. |
| Bus-tie contactor .. .. .. | 50/55 lb in. |

For other components, use standard torque loading figures appropriate to thread diameter, given in para.4.A.

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...Electrical power - Maintenance practices continued

## 5. Terminal blocks - Ward, Brooke & Co. Ltd., type

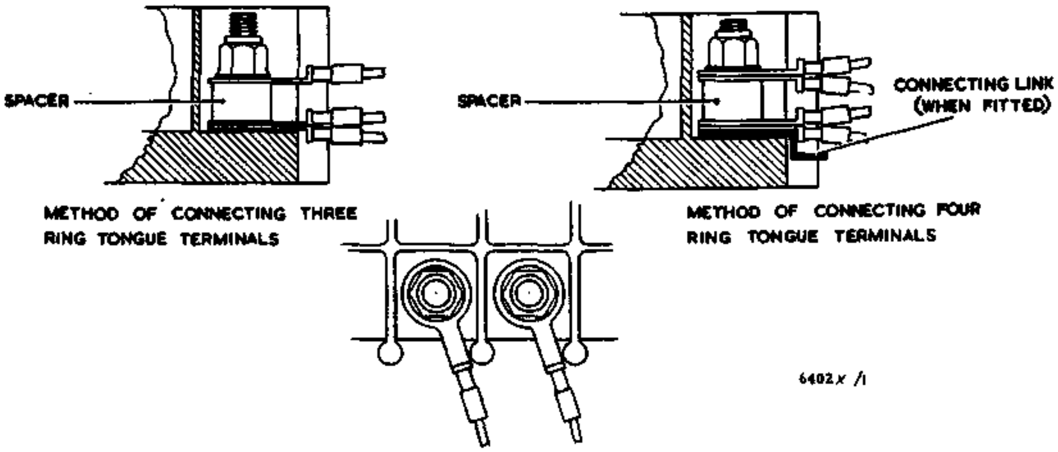
### A. Terminal post cable loading (Fig.206)

(1) Ensure that cable ring tongue terminals, spacers and connecting links, are positioned correctly on the appropriate terminal post.

(2) Fit terminal nut and torque tighten (see para.5.B.).

NOTE : When connecting ring tongue terminals of 10-32 UNF or less, the cable must be held in the anti-clockwise extremity before tightening. This is to ensure that any pull on the cable, will tend to tighten rather than loosen the connection.

NOTES
THE METHOD SHOWN BELOW IS ALSO EMPLOYED ON SINGLE BLOCKS WHERE ACCESS IS LIMITED TO ONE SIDE.
MAXIMUM LOADING IS FOUR TERMINALS ON ONE STUD.


SPACER
SPACER
CONNECTING LINK (WHEN FITTED)
METHOD OF CONNECTING THREE RING TONGUE TERMINALS
METHOD OF CONNECTING FOUR RING TONGUE TERMINALS
6402X /1

Typical terminal post loading
Fig.206

(3) To prevent corrosion or verdigris forming, spray all electrical connections at terminal blocks outside the pressurized area, with Hellermann 'Fospro 2-26'.

NOTE : Do not apply an excessive amount, a one second burst from the aerosol container should be adequate in most positions.

WARNING : 'FOSPHRO 2-26' IS INFLAMMABLE, DO NOT SMOKE OR USE NEAR NAKED FLAMES OR HEATED EQUIPMENT.

(4) Fit terminal block covers, where applicable.

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## B. Torque loading of terminal nuts

(1) When tightening terminal nuts, use the appropriate Ward, Brooke (or equivalent) torque spanner, to ensure that the correct torque loading is applied for the relevant terminal post size (see Table 203).

### TABLE 203
### TORQUE LOADING OF TERMINAL NUTS

| Stud size | Torque Loading | Ward,Brooke Spanner Part No. |
|---|---|---|
| 4 UNC (0.125 in. A/F HEX.6 Point nut) | 3.5 lb.in. $^{+25\%}_{-0}$ | WB808/1246/Set to 3.5 lb.in. |
| 6 UNC (0.156 in. A/F HEX.6 Point nut) | 9 lb.in. $^{+0}_{-10\%}$ | WB808/1146/Set to 9 lb.in. |
| 8 UNC (0.187 in. A/F HEX.6 Point nut) | 12.5 lb.in. $^{+25\%}_{-0}$ | WB808/1646/Set to 12.5 lb.in. |
| 10 UNC (0.25 in. A/F HEX.6 Point nut) | 21 lb.in. $^{+25\%}_{-0}$ | WB808/1346/Set to 21 lb.in. |

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## 6. Pressure bungs

### A. General (Fig.207)

Pressure bungs permit the passing of unbroken lengths of cables through pressure bulkheads whilst maintaining a seal between either side of bulkhead. The pressure bung housing is flanged and threaded, having a bore hole to accept a bung. The bung is perforated, and the holes vary in size to accommodate cables of various diameters. The cables are a tight fit in the bung holes which when fully loaded and forced into its housing by the clamp nut is compressed tightly around the cables. All unwired holes are sealed by fitting the appropriate size of filler plug. Each bung should be periodically inspected for 'creep' (movement due to pressure cycling) relative to bung housing assembly. Pressure bung installations include 'normal' and 'reverse' assemblies, both assemblies having tapered bungs fitting into housings having a tapered bore.

The outer face (unpressurized side) of a 'normal' assembly bung must be 0.1 in. or more behind the outer face of the housing. For a 'reverse' bung assembly, the unpressurized face of the bung must not protrude beyond the outer face of the wedge ring.

Table 204 summarizes a general arrangement of bung locations the number of bungs will vary depending on particular installations.

TABLE 204

BUNG LOCATIONS

| Location | Bung identification |
|---|---|
| Front pressure bulkhead (frame 2) | CV : CW : CX : RZ : CB |
| Rear pressure bulkhead (frame 19) | DG : DH : DJ : ER : ES : YG : YJ |
| Fuselage keel at front spar (frame 13) | DC : DD : HQ : DF : DB |
| Cabin top skin forward of rear pressure bulkhead (frame 18 to 19) | SR : FR |

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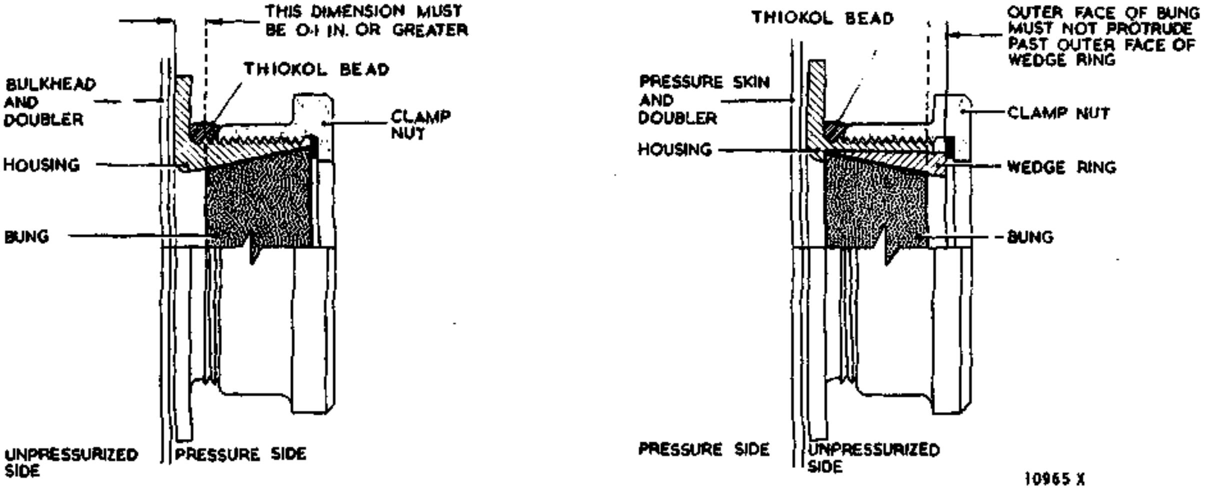


NORMAL ASSEMBLY

REVERSE ASSEMBLY

'Normal' and 'Reverse' bung assemblies
Fig.207

B. Inspection/Check for displaced pressure bung

(1) Locate (see Table 204) and gain access to pressure bung(s).

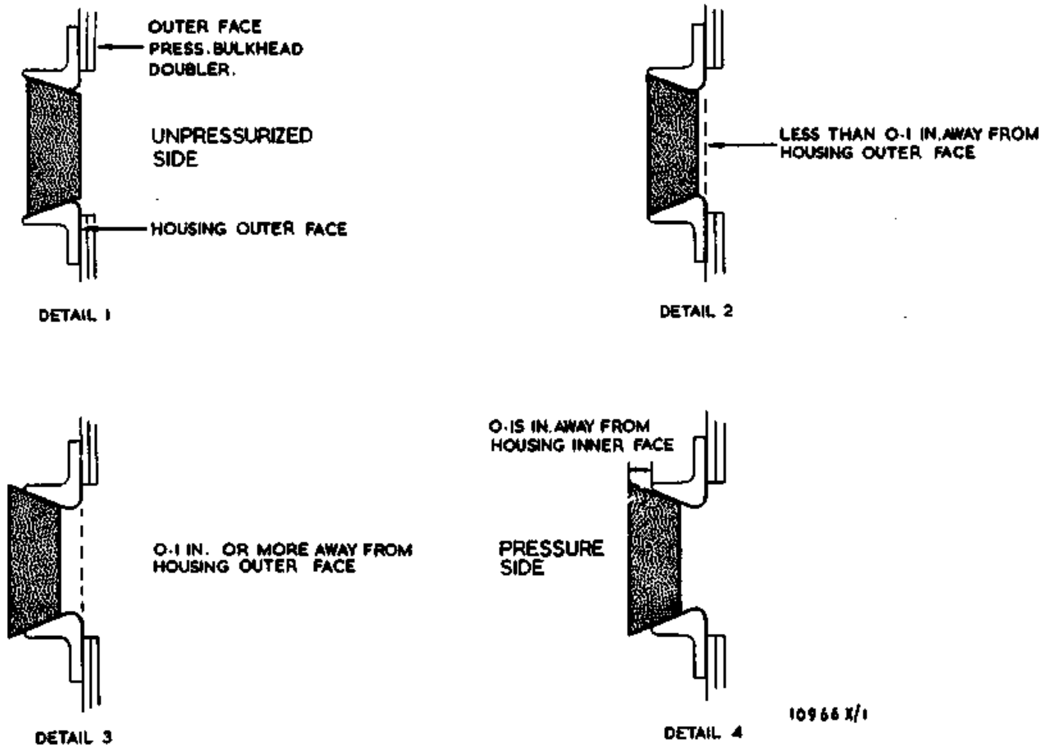
(2) Check 'normal' or 'reverse' bung for movement relative to bung housing outer (unpressurized) face, or wedge ring, as follows :-

(a) If 'normal' bung is in line with, or has moved beyond the housing outer (unpressurized) face (see Fig.208, Detail 1) rectify in accordance with para.C.

(b) If 'normal' bung is less than 0.1 in. away from, but not in line with housing outer face (see Fig.208, Detail 2) re-check for further movement at subsequent (Service 'A') inspections. Provided bung remains within the requirements of this operation, rectification in accordance with para.C. may be delayed until next annual inspection.

(c) If 'normal' bung is 0.1 in. or more away from the housing outer face (see Fig.208, Detail 3) no action is required.

(d) For a 'reverse' bung, ensure that outer (unpressurized) face of bung does not protrude beyond the outer face of wedge ring (see Fig.207). If bung does not comply with this requirement rectify in accordance with para.C.


OUTER FACE PRESS.BULKHEAD DOUBLER.
UNPRESSURIZED SIDE
HOUSING OUTER FACE
DETAIL 1
LESS THAN 0·1 IN.AWAY FROM HOUSING OUTER FACE
DETAIL 2
0·1 IN. OR MORE AWAY FROM HOUSING OUTER FACE
DETAIL 3
0·15 IN.AWAY FROM HOUSING INNER FACE
PRESSURE SIDE
DETAIL 4
10966 X/1

Typical bulkhead pressure bung installation
Fig.208

C. Rectification for displaced pressure bungs

Materials required :

| | |
|---|---|
| Thiokol .. .. .. | PR1422BT½ |
| Cleaning agent .. .. <br>(alcohol based) | Methylated spirit<br>Arklone P<br>Methanol<br>Iso-propanol |

NOTE : Cleaning agents such as Ketones, hydro-carbon or chlorinated solvents must not be used.

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Release and remove clamp nut and washer from bung housing assembly.

(3) Remove bung, or bung and wedge ring, (reverse assembly) from its housing, taking care not to impart any load on cable loom.

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(4) Clean bung, or bung and wedge ring, and housing with cleaning agent ensuring that all traces of assembly lubricants are removed.

NOTE : Care must be taken to avoid contamination of cables.

(5) Ensure bung, or bung and wedge ring, are serviceable.

(6) Apply Thiokol to mating faces of bung and housing ('normal' assembly) or to taper surfaces of bung and wedge ring ('reverse' assembly) to ensure a 'normal' bung protrusion of 0.15 in. or until 'reverse' bung does not protrude past the outer face of wedge ring after assembly.

(7) Refit bung, or bung and wedge ring, in housing. Check that 'normal' bung protrudes 0.15 in. away from housing inner face (see Fig.208, Detail 4) or 'reverse' bung does not protrude past outer face of wedge ring (see Fig.207).

(8) Clean off excess Thiokol and allow time to cure.

(9) Fit washer and secure clamp nut. The tightness of the clamp nut is to be checked after the first subsequent aircraft pressurization and a small bead (pea-sized) of Thiokol is to be placed so as to fill the gap between the bung housing flange and clamp nut.

(10) Refit all items removed for access and restore electrical circuit.

## 7. Diode testing

### A. General

The following non-quantitative test is a simple means of determining whether a diode is serviceable for use as a d.c. blocking device. If the diode is being tested in situ, at least one terminal must be disconnected from circuit wiring, to ensure there are no parallel circuits. Identification of diode terminals anode and cathode, vary with differing manufacturers. Therefore, for a given type of diode consult the relevant diode data sheet. Some diode terminal idents are symbolic, whereas other variants include a colour spot or a conventional (resistor) colour code scheme (see Fig.209) to reflect its type number.

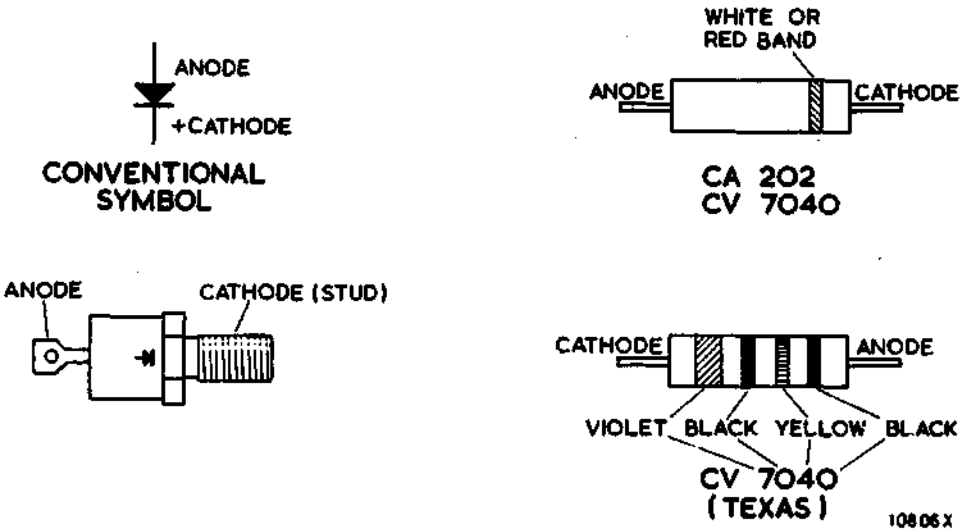
### B. Diode resistance test

Equipment required :-

Avometer model 8 or equivalent

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) As necessary, disconnect diode electrical connection(s).



Typical diodes
Fig.209

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(3) Set Avometer on ohms x 1 scale, connect meter red (+) lead to cathode end of diode and meter black (-) lead to anode end of diode (see Fig.209). Check for a low ohms reading as compared with a known good device.

NOTE : Do not handle diode during operation (3).

(4) Reset Avometer to ohms x 100 and reverse connections to diode. Check that a high resistance (negligible reading) value is obtained.

(5) Connect diode in its electrical circuit.

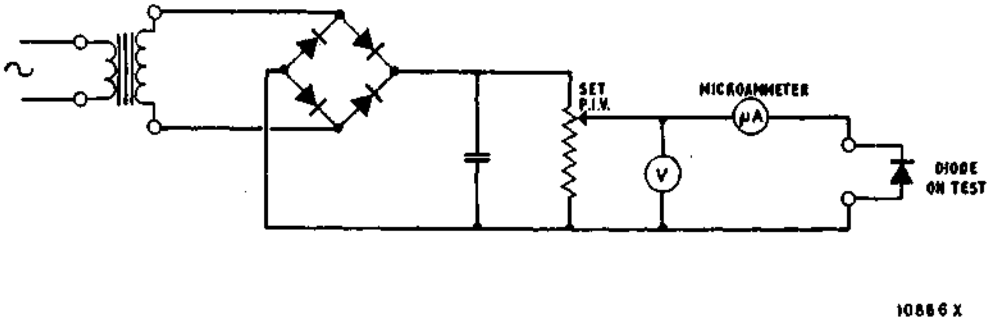
(6) Restore electrical circuit.

(7) Functionally test relevant circuit.

C. Diode peak inverse breakdown voltage test

NOTE : The test carried out in para.B will not show up a faulty diode which has a low peak inverse breakdown voltage (PIV). This can be detected using a test circuit as shown on Fig.210.

(1) Connect as shown in Fig.210 to a suitable power supply.



Test circuit - reverse diode leakage
Fig.210

(2)Set PIV potentiometer until voltmeter reading indicates the diode recommended PIV (see data sheet) and check that micro ammeter indicated leakage current does not exceed its specification value.

(3) Switch off, and disconnect power supply.

* * *

## CONSTANT FREQUENCY SYSTEM - DESCRIPTION AND OPERATION

(Mods.252702, 256574, 258217; Pre mod.258208)

### 1. Description

115 volts 400 Hz single phase a.c. supplies are provided by two main 2.5 kVA static inverters No.1 and No.2. A third static 250 VA inverter provides 115 volts 400 Hz single phase a.c. to supply the essential services should the main inverters fail.

Fig.1 shows the location of the various components employed in the system, and Fig.2 is a system schematic diagram.

The main inverters are installed in the rear equipment bay, on a quick release tray secured to the fuselage shelf structure. Cooling of each main inverter is provided by an integral, brushless, fan motor. The fan induces airflow through the inverter rear panel intake screen and exhausts the air at the inverter side and front screen panels.

The standby inverter is also installed in the rear equipment bay, on panel TJ. The inverter case is finned and embodies vent holes, to enable cooling by natural convection. Should the inverter temperature rise abnormally high (165°F) an integral, thermostatically-controlled, d.c. blower motor automatically switches on to provide additional cooling.

Three switches (annotated INV 1, INV 2 and STBY INV) located on roof panel CG, control the inverters. The main inverter switches have three positions, START (momentary) STOP (momentary) and a central ('normal operating' and 'off') spring-loaded position. The third inverter control switch, is a single-pole two position ARM-OFF switch.

D.c. supplies for control of the three inverters are taken from busbars PS1 (No.1), PS2 (No.2) and PE (standby). The main inverter inputs are routed via fuses and contactors on panel ZC. The standby inverter input is fed from busbar PE on panel ZL via a supply relay on panel TJ.

A single-phase output from each main inverter is fed to XS1 and XS2 distribution terminal blocks (a.c. busbars), No.1 inverter to XS1 and XE, and No.2 inverter to XS2. The standby inverter output is only connected to XE distribution block when both main inverters have failed. The distribution terminal blocks are contained in panel DA, sub-panel M.

Each main inverter output is connected to XS busbar through a related relay on panel ZC, and XE busbar is supplied through a relay on panel DA, sub-panel J. Although each main inverter incorporates integral and output circuit protection against abnormal voltage and frequency conditions, additional system protection is provided by a protection unit fitted on panel ZC. The protection unit senses inverter output for variations of voltage and frequency outside of the normal pre-determined limits and controls an integral relay, which will operate during fault conditions to de-energize the inverter input contactor.

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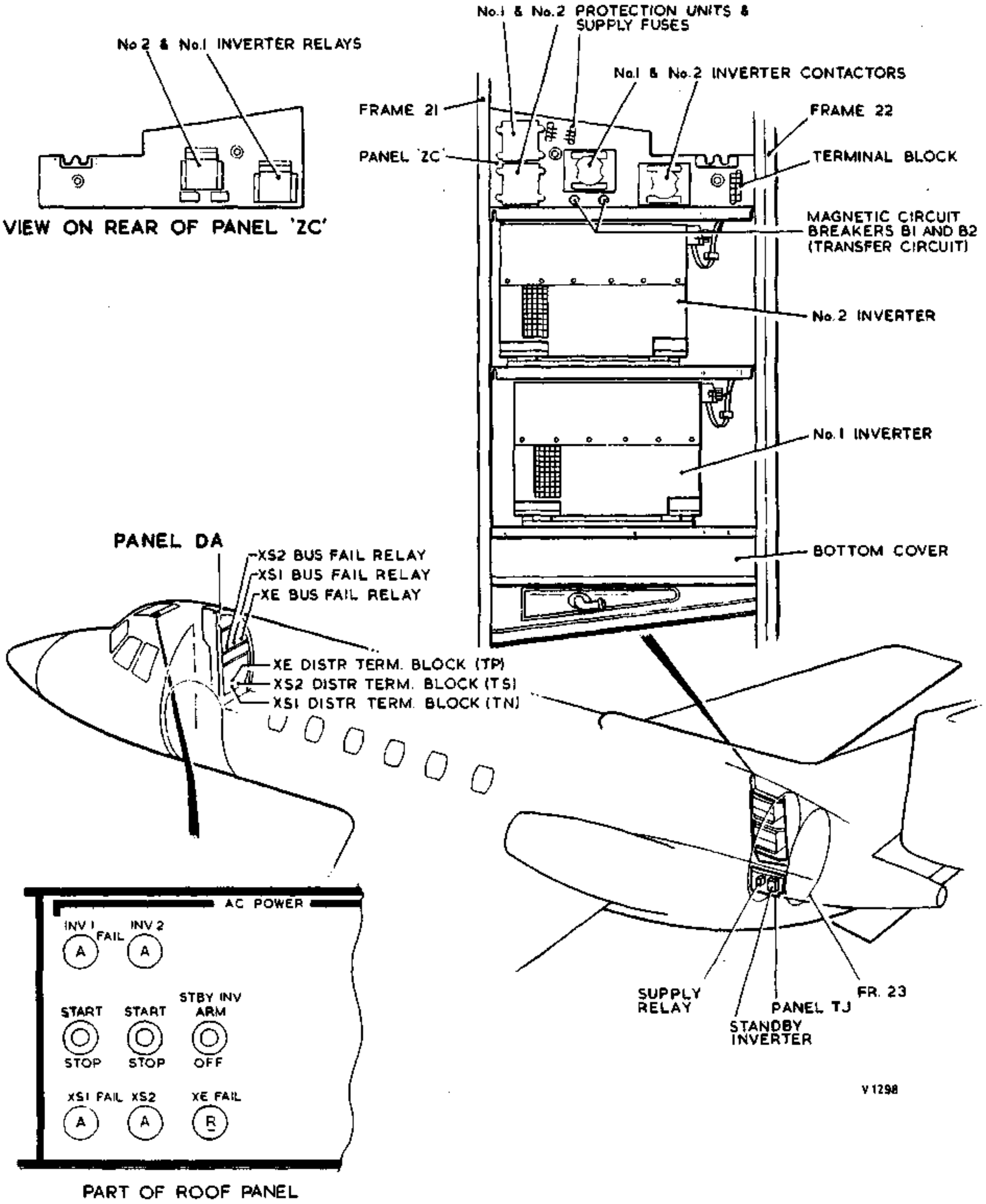


Inverter system - component location
Fig.1

...Constant frequency system - Description and operation continued

The inverter contactor (relaxed) disconnects the faulty inverter input, and de-energizes the associated relay, to disconnect the inverter output to the busbar. The inverter relay contacts (relaxed) enable the remaining main inverter to automatically support busbars XS and XE via the change-over circuit. The change-over circuit supply is protected by a magnetic circuit breaker, to ensure that a busbar, or supply fault, does not result in the loss of both main inverters.

The inverter system failure lamps are grouped with the inverter switches on the AC POWER section of the roof switch panel. The main inverter failure lamps are annotated INV 1 and INV 2 FAIL and the a.c. busbar failure lamps are annotated XE, XS1 and XS2 FAIL. Fault discriminants to the lamps are derived from PE busbar via the main inverter protection unit relays (relaxed) and the a.c. busbar failure relays (relaxed). The a.c. busbar failure discriminants are also fed to the c.a.g.s.

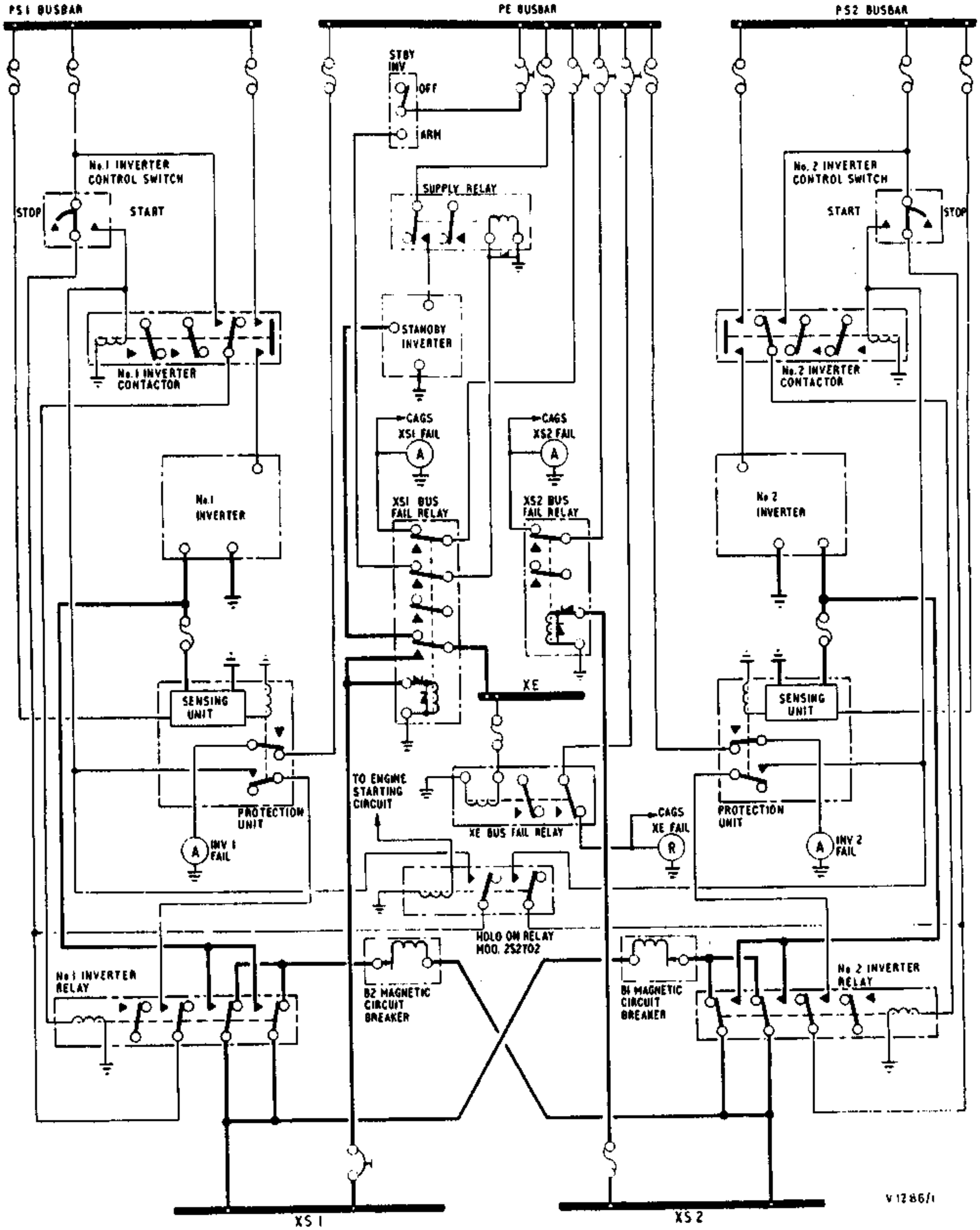
2. Operation (Fig.2)

As the functioning of No.1 and No.2 inverter circuits is similar, only the No.1 and standby inverter circuit operations are described.

With the aircraft busbars energized, the c.a.g.s. is activated and INV 1, XS1 and XE FAIL lamps light. A supply from PS1 busbar is fed, via INV 1 control switch (central position) to a set of contacts (normally open) in the No.1 inverter relay; it is also fed to relaxed contacts of No.1 inverter contactor, and, when the system is in operation, forms part of No.1 inverter contactor hold-on circuit.

When the INV 1 control switch is set and held to START, it connects a PS1 supply to the protection unit and energizes the No.1 inverter contactor coil. The contactor contacts change over, the main contacts connect a PS1 supply to the No.1 inverter input, and the auxiliary contacts connect a supply to energize No.1 inverter relay. The inverter output builds-up, and is connected to XS1 and XE busbar through the operated contacts of the inverter relay (XS2 is also energized if No.2 inverter is switched 'off'). When the inverter reaches its normal output, the protection unit sensing circuit-controlled relay operates to complete the inverter contactor hold-in circuit and thus extinguish INV 1 FAIL lamp. With XS1 energized, the XS1 bus fail relay is also energized, and its contacts change over to energize XE busbar from XS1 supply, inhibit the c.a.g.s. input and also extinguish XS1 FAIL lamp. With XE energized, the XE bus fail relay is also energized to disconnect the c.a.g.s. fault signal and also to extinguish the XE FAIL lamp.

During normal conditions, No.1 and No.2 inverters are operating together, No.1 inverter supplying XS1 and XE, and No.2 inverter supplying XS2; the standby inverter control switch is set to the ARM position.



Inverter system - Schematic diagram
Fig.2

...Constant frequency system - Description and operation continued

Should a main inverter output voltage or frequency vary outside predetermined limits, its control unit or the protection unit sensing circuit control unit, will operate to interrupt the inverter contactor hold-on circuit. The contactor will be de-energized and its contacts will relax to de-energize the inverter relay. This results in the faulty inverter input and output being disconnected, and through the relaxed contacts of the inverter relay, the remaining main inverter will supply XS1, XE and XS2 distribution terminal blocks. During the latter automatic switching, the INV FAIL lamp will light but XS and XE annunciators will not be illuminated.

During engine starting using ground power, the voltage drop could be sufficient to cause an 'on-line' main inverter to be rejected unnecessarily. To prevent this, a hold on relay is introduced (Mod.252702) which is energized during engine starting procedures to inhibit the protection unit function and provide an alternative hold-on supply for the inverter input contactors; the relay is maintained energized until the START PWR switch is set to OFF.

Setting a main inverter control switch to STOP breaks the contactor and relay hold-on circuit, which is established during normal operation, and isolates the inverter from the system.

In the event of both main inverters failing, the c.a.g.s. lamps flash, and INV 1, INV 2, XS1 and XS2 FAIL lamps will light. XE FAIL lamp will remain unlit as the essential busbar XE is maintained in the energized state from the output of the standby inverter, as its control switch was preselected to the ARM position. Failure of XS supplies effects the relaxation of XS1 bus fail relay, which connects a d.c. supply from PE busbar to energize the supply relay. The supply relay contacts change over and connect PE busbar supply to the standby inverter input. The output of the standby inverter supplies XE busbar via the relaxed contacts of No.1 inverter bus fail relay.

* * *

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## CONSTANT FREQUENCY SYSTEM - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Functionally test constant frequency system

Equipment required :

Avo Mk.8 or equivalent with test probes to read 115 volts a.c. (nom.)
Frequency meter (300-500 Hz)

(1) Ensure power is disconnected from the relevant circuits (see Chapter 24, GENERAL) and at the rear of panel DA lower the terminal block panel cover.

(2) Connect and switch on an external 28 volt ground supply.

(3) Set EXT PWR switch at ON.

(4) Using voltmeter and selector switch on roof switch panel ensure that ground supply is established at PS1, PS2 and PE busbars.

(5) Check that INV 1, INV 2, XS1, XS2 and XE FAIL lamps are lit. Cancel c.a.g.s.

(6) Set and hold INV 1 switch to START. Check that INV 1, XS1, XS2 and XE FAIL lamps go out; release switch.

(7) Apply the frequency meter and Avometer between terminals TN1R-TN5R and earth, TS1R-TS5R and earth and TP1R-TP4R and earth in turn and check that voltmeter reads 110 to 118 volts a.c. and the frequency meter reads 396 to 404 Hz.

(8) Set and hold INV 2 switch to START. Check that INV 2 FAIL lamp goes out; release switch.

(9) Set the STBY INV switch to ARM.

(10) Select INV 1 switch at STOP. Check that INV 1 FAIL lamp lights but that XS1 FAIL lamp does not light.

(11) Repeat operation (7).

(12) Select INV 2 switch at STOP. Check that INV 2, XS1 and XS2 FAIL lamps light and the c.a.g.s. lamps flash; cancel c.a.g.s.

(13) Apply voltmeter and frequency meter between terminals TP1R-TP4R and earth. Check that the voltmeter reads 107 to 121 volts a.c. and the frequency meter reads 396 to 404 Hz.

(14) Set the STBY INV switch at OFF. Check that the XE FAIL lamp lights and the c.a.g.s. lamps flash; cancel c.a.g.s.

...Constant frequency system - Maintenance practices continued

(15) Set the EXT PWR switch at OFF. Check that all FAIL lamps go out.

(16) Switch "off" and disconnect ground supply.

(17) Remove testmeters and raise and secure the terminal block panel cover.

* * *

## JET ELECTRONICS INVERTER TYPE-S1-2500B - MAINTENANCE PRACTICES

### 1. Removal/Installation

### A. Remove inverter

(1) Isolate electrical supply and, in the rear equipment bay, on panel ZK, remove fuse F1 for the No.1 inverter or fuse F2 for No.2 inverter.

(2) At the inverter compartment, disconnect the a.c. connector, remove terminal block cover and disconnect the d.c. input cables. Refit washers, nuts and terminal block cover and fit a dust cover to the a.c. connector.

(3) CAUTION : INVERTER WEIGHS APPROXIMATELY 45 LBS.

Remove bolts securing inverter mounting tray assembly to shelf support structure. Withdraw assembly until tray spigots are clear of the shelf bracket and remove mounting tray complete with inverter from aircraft.

(4) Remove bolts, washers and nuts securing inverter to mounting tray and withdraw inverter. If inverter is to be transported, blank off cooling screens.

### B. Install inverter

Equipment required :

250 volts insulation resistance tester

(1) Ensure that the inverter cooling screens are unobstructed and remove connector dust cover.

(2) Examine mounting tray mounting blocks for damage and security of attachment.

(3) Place inverter on mounting tray mounting blocks and secure with bolts, washers and nuts.

(4) Locate inverter complete with mounting tray in aircraft support structure. Ensure that the tray spigots locate in shelf bracket and secure tray assembly to support structure shelf.

(5) Using a 250 volts insulation resistance tester check between frame of inverter and aircraft structure ensuring that the resistance is not less than 20 megohms.

(6) Remove inverter terminal block cover, connect and secure d.c. cables (assuring correct polarity) to the terminal block studs each with a plain washer, lockwasher and nut. Refit terminal block cover.

(7) Connect and secure a.c. output connector to inverter.

(8) Refit fuse removed in A.(1).

(9) Restore electrical supplies.

(10) Functionally test inverter system (see Chapter 24, CONSTANT FREQUENCY SYSTEM).

(11) Close and seucre rear equipment bay door.

* * *

# RANDOM FREQUENCY WINDSHIELD POWER SYSTEM - DESCRIPTION AND OPERATION

## 1. Description

### A. General

Electrical power for the windscreen anti-ice system is obtained from a single a.c. generator, mounted on the right-hand (No.2) engine, or post modification 258039 two a.c. generators, the second generator being mounted on the left-hand (No.1) engine accessory gearbox. Each generator is controlled by a generator control unit (g.c.u.) mounted in the rear equipment bay in conjunction with a control switch on the roof switch panel CG (Fig.1).

In a dual installation, both systems can be operated independently of one another, each to supply one of the two heated windshield panels; normally the left (No.1) a.c. generator supplies the left windshield panel and the right (No.2) generator supplies the right windshield panel. In the event of a generator failure, the remaining unit will supply both systems.

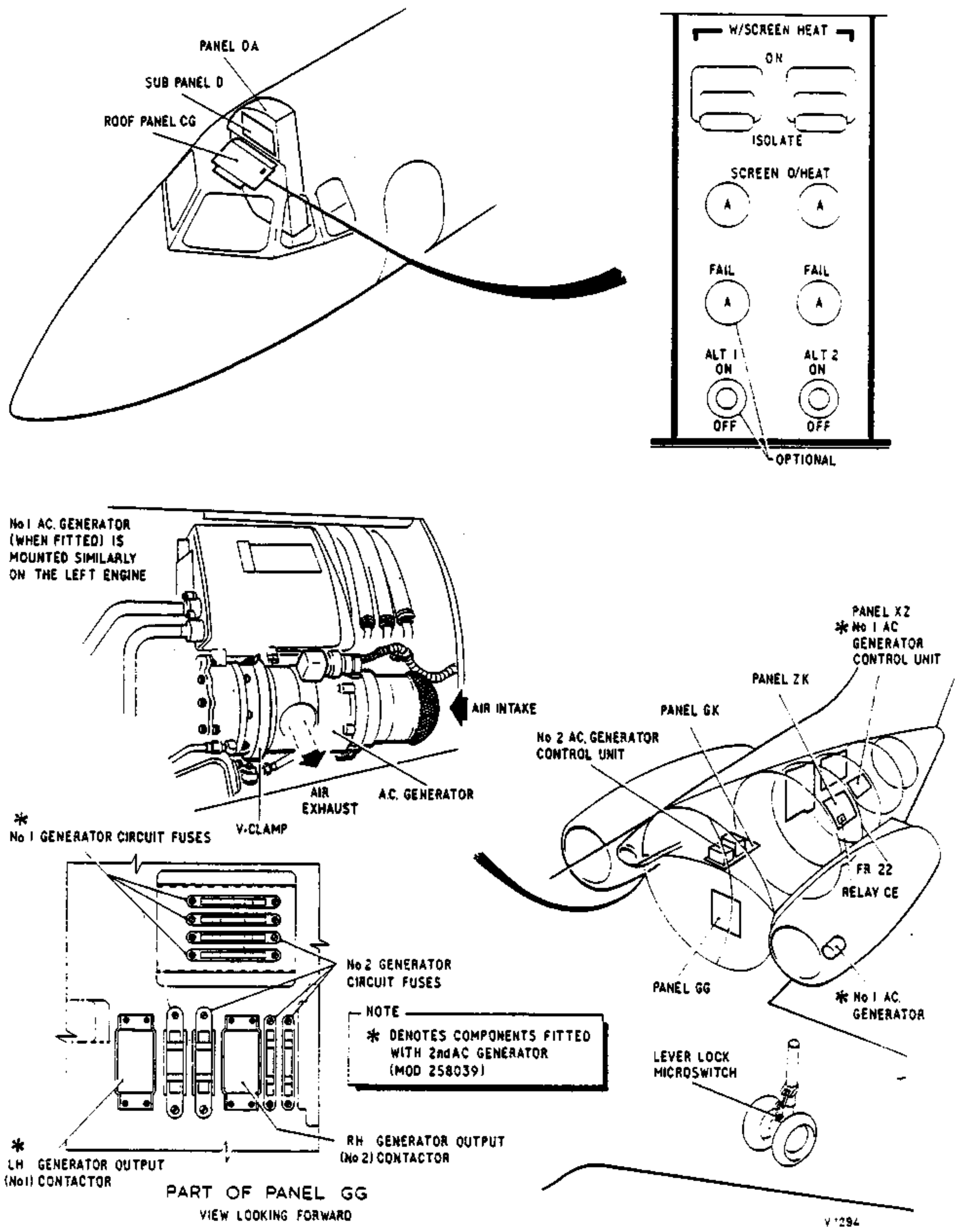
### B. AC generator

Each generator is a single-phase, brushless, machine which during flight conditions has an output rating of 4.4 kVA at 120 volts r.m.s. over the speed range of 6600 to 12 000 r.p.m. On the ground, a generator output rating is 2.2 kVA at 83 volts r.m.s. over the speed range of 5760 to 12 000 r.p.m. Generator frequency varies in direct proportion to its speed, and operates at a frequency of 400 Hz when driven at a speed of 12 000 r.p.m. The generator is a two stage machine; the first stage consists of an exciter, which provides excitation power for the second stage. Both stages share a common rotor shaft and stator frame. The exciter output is rectified by six, armature-mounted diodes, and is delivered to the field winding of the main generator rotor. The generator second stage has a four-pole rotating field and a single-phase stator from which the machine output is taken. The generator rotor is supported by two sealed bearings; an oil thrower is located at the drive end and a cooling fan at the opposite end. The machine is fitted with a shear-necked stub shaft, splined at both ends for engaging with the engine accessory gearbox and generator rotor shaft. Intake of cooling air is through a wire gauze within the engine cowl and exhaust is through the generator casing holes at the drive end.

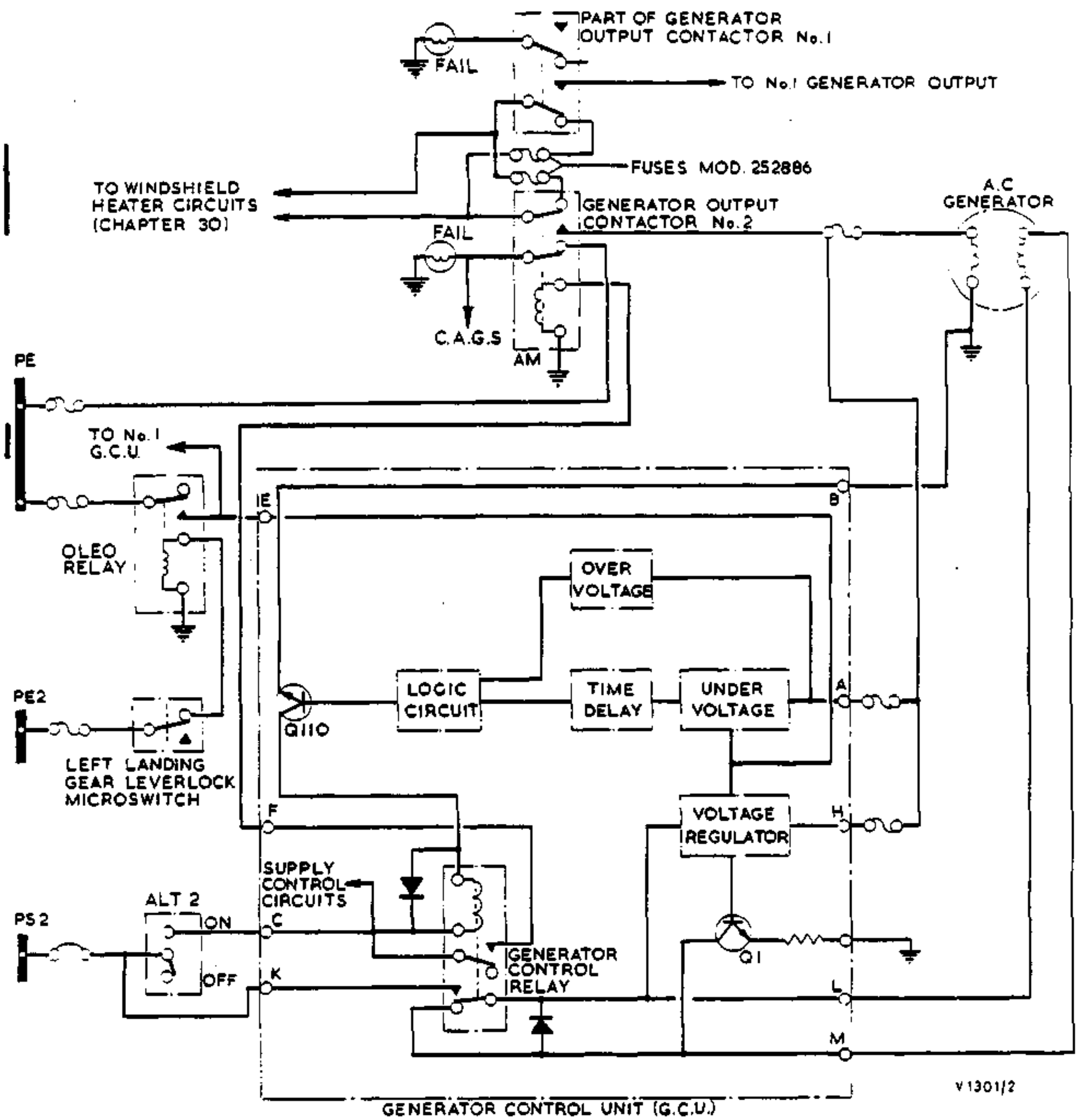
### C. Generator control unit (g.c.u.)

Each g.c.u. provides associated generator voltage regulation, channel protection and logic-controlled switching. The regulator circuit controls the generator output over the speed range of 5760 to 12 000 r.p.m. by varying the excitation current to the main exciter field winding. The excitation current is supplied from busbar PS2 and is varied by altering the mark/space ratio of transistor Q1 control circuit, connected in series with the generator field winding. The required mark/space ratio is determined by comparing a d.c. signal derived from, and proportional to,

...Random frequency windshield power system - Description and operation continued


PANEL OA
SUB PANEL D
ROOF PANEL CG
W/SCREEN HEAT
ON
ISOLATE
SCREEN O/HEAT
A
A
FAIL
FAIL
A
A
ALT 1 ON
ALT 2 ON
OFF
OFF
OPTIONAL
No 1 AC GENERATOR (WHEN FITTED) IS MOUNTED SIMILARLY ON THE LEFT ENGINE
AIR INTAKE
AIR EXHAUST
A.C. GENERATOR
V-CLAMP
PANEL X2
✱ No 1 AC GENERATOR CONTROL UNIT
PANEL ZK
PANEL GK
No 2 AC GENERATOR CONTROL UNIT
FR 22
RELAY CE
PANEL GG
✱ No 1 AC GENERATOR
LEVER LOCK MICROSWITCH
✱ No 1 GENERATOR CIRCUIT FUSES
No 2 GENERATOR CIRCUIT FUSES
NOTE
✱ DENOTES COMPONENTS FITTED WITH 2nd AC GENERATOR (MOD 258039)
✱ LH GENERATOR OUTPUT (No 1) CONTACTOR
RH GENERATOR OUTPUT (No 2) CONTACTOR
PART OF PANEL GG
VIEW LOOKING FORWARD
V 1294

Random frequency power system - component location
Fig.1



NOTE : AS BOTH GENERATORS CONTROL CIRCUITS IN A DUAL INSTALLATION ARE SIMILAR, ONLY ONE SYSTEM (No.2) IS SHOWN WITH THE SYSTEM INTERLOCKS.

Random frequency a.c. generating system - schematic diagram
Fig.2

the generator line to neutral voltage with an accurate reference voltage, to produce a resultant signal to adjust the field winding current. The regulator sensing circuit has a connection which allows the point of regulation to be changed from the nominal 115 volt level (flight condition) to 80 volts (nominal) when the aircraft is on the ground, to prevent the possibility of thermal shock damage to the windshield.

Channel protection for the generator and windshield is provided by the over and undervoltage sensing circuits. An overvoltage fault signal is generated when the generator output exceeds 125 ± 3 volts in the flight condition or 100 ± 3 volts on the ground. Also, an undervoltage fault signal is developed when the generator output falls to 90 ± 3 volts in the flight condition or 65 ± 3 volts on the ground. A fault signal from the over or undervoltage circuit (via a time delay) is processed through a logic circuit, to switch 'off' transistor Q110 and de-energize the generator control relay. The relay contacts relax to interrupt the units internal supplies and generator excitation supply, which causes the generator to de-excite. The logic circuit includes a 'latch-in' function to prevent cycling during fault conditions. After fault clearance, removal of 'latch-in' circuit requires the related alternator control switch to be selected OFF, and then ON for generator reinstatement.

### D. System control and indication

Each generator is controlled by an ON-OFF switch on roof panel CG. When a switch is selected OFF, the related generator is de-excited and its associated output control contactor is de-energized. The contactor (relaxed) open-circuits the generator output line to the windshield heater elements and makes the circuit to an associated FAIL lamp. On No.2 system when the contactor relaxes a signal is also fed to the CAGS.

When a generator is being driven (engine running), selection of the relevant control switch to ON will connect a PS2 busbar supply to provide the g.c.u. with internal circuit supplies and generator field excitation.

The time delay prevents the undervoltage detector from tripping the logic circuit while the generator output builds up, allowing the generator control relay to remain energized to supply field power and operate the generator output contactor. The contactor contacts will connect the generator output to the windshield heater circuit, extinguish the relevant FAIL lamp and cancel the fault signal to the CAGS (No.2 system).

On the ground, the g.c.u.'s automatically regulate the generators at a reduced output of 80 ± 3 volts. This is achieved by utilizing the left main landing gear lever lock microswitch to control a relay (oleo relay) on panel ZK, which, when energized, will connect PE busbar supply to the g.c.u.'s and cause each voltage regulator to shift its regulation point to a reduced level. During airborne conditions, the oleo relay is de-energized and interrupts the d.c. supply to the g.c.u. regulator, which permits a regulated generator output of 115 ± 2 1/2 volts.

## 2. Operation (Fig.2)

With the aircraft on the ground, engines running and alternator switches OFF, the generator field is short circuited by the relaxed contacts of the generator control relay. The relaxed contacts of the generator output contactor isolate any residual generator output from the windshield heater system, and connect a supply from PE busbar to light the related FAIL warning light on roof panel CG and, on No.2 system, to trigger the CAGS (Chapter 33, CENTRAL ATTENTION GETTING SYSTEM).

The oleo relay is energized by a supply from PE2 busbar routed through the left landing gear lever lock microswitch while the aircraft is on the ground, to connect a PE busbar supply to the g.c.u. voltage regulation circuit. This results in reduced generator output while the aircraft is on the ground.

Selecting an alternator control switch to ON connects PS2 busbar to the g.c.u. supply control circuits and the coil of the generator control relay. The time delay prevents the undervoltage detector from triggering the logic circuit while generator output builds up. Transistor Q110 is switched on allowing the generator control relay to energize, removing the short from, and connecting the supply to the voltage regulator and field circuit to excite the generator. The generator control relay also connects a supply to energize the generator output contactor to extinguish the FAIL lamp and connect heating power to the windshield system.

If a generator develops under or overvoltage symptoms, the relevant sensing circuit will feed a fault signal to the logic circuit which will switch off transistor Q110, removing the earth from the generator control relay coil. The contacts relax and de-excite the generator and remove the supply from the generator output contactor coil, which, in its de-energized state, will disconnect the generator from the windshield system and light the relevant FAIL lamp and, on No.2 system, trigger the CAGS.

In a dual generator installation both windshields will be supplied from the remaining generator via the output contactor interlocks. Mod.252886 introduces fuses into the interlocks to prevent a high current heater fault being transferred to the other generator.

The logic circuit has a 'latching' function to prevent cycling of the fault. The latch may be reset by selecting the relevant alternator control switch to OFF, then back to ON.

* * *

## RANDOM FREQUENCY WINDSHIELD POWER SYSTEM - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Functionally test random frequency windshield power system

NOTE : Modification 258039 introduces wiring for and installation of a second a.c. generator. The test procedure following is written to cover a dual installation although a single generator system can be checked by effecting operations (1) to (7), (11), (13), (15) and (16). Nomenclature in brackets, e.g. (ALT FAIL) is relevant to single generator installations.

(1) Energize the d.c. busbars (see Chapter 24, GENERAL). Check that the (ALT 1 FAIL) and ALT 2 FAIL lamps light and the c.a.g.s. operates. Cancel c.a.g.s.

(2) Run No.2 engine (see Chapter 71, GENERAL).

(3) Set the WINDSHIELD HEAT, ALT 2 switch to ON and check that the ALT 2 FAIL lamp goes out.

(4) On panel GG in the rear equipment bay, apply the testmeter between terminal R1OR and earth (*7); check that the meter reading is between 77 and 83 volts a.c. On dual a.c. generator installations apply the testmeter also between terminal R1OL and earth (*7) and check the meter reading is between 77 and 83 volts a.c.

(5) CAUTION : IN LOW AMBIENT TEMPERATURES, TO PREVENT THERMAL SHOCK TO THE PANELS, WINDSHIELD HEAT SHOULD BE ON FOR AS LONG AS POSSIBLE (UP TO 30 MINUTES) IN THE GROUND CONFIGURATION (80 ± 3 VOLTS) BEFORE THE HIGHER IN-FLIGHT VOLTAGE (115 ± 2.5 VOLTS) IS APPLIED.

Obtain assistance in operating the left main gear lever lock microswitch. Again apply the testmeter between terminal R1OR and earth (*7) and check that the meter reads between 112.5 and 117.5 volts whilst the microswitch is operated. Release microswitch.

(6) Set the WINDSHIELD HEAT L and R switches to ON and check that when applied between terminal R1OR and earth (*7) the meter reads between 77 and 83 volts a.c. Check for heat at the windshield by feel.

NOTE : In high ambient temperature with windshield heat selected on, generator output may not be applied to the windshield.

(7) Repeat operation (5).

(8) Run No.1 engine (see Chapter 71, GENERAL).

(9) Set WINDSHIELD HEAT, ALT 1 switch to ON and check that ALT 1 FAIL lamp goes out.

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...Random frequency windshield power system - Maintenance practices continued

(10) Repeat operations (4), (5), (6) and (7) with the testmeter applied between terminal R10L and earth (*7).

(11) Set WINDSHIELD HEAT, ALT 2 switch to OFF; check that ALT 2 FAIL lamp lights and the c.a.g.s. operates. Cancel c.a.g.s.

(12) Apply testmeter between terminal R10R and earth (*7) and check that the meter reads 77 to 83 volts a.c.

(13) Set WINDSHIELD HEAT SCREENS L and R switches to OFF.

(14) Set WINDSHIELD HEAT ALT 1 switch to OFF, check that the ALT 1 FAIL lamp lights.

(15) Shut down engine(s) (see Chapter 71, GENERAL).

(16) De-energize the d.c. busbars.

* * *

## AC GENERATOR - MAINTENANCE PRACTICES

### 1. Unit servicing (BA00501-1, Mod.252831 only)

#### A. Lubricate drive end bearing (Fig.201)

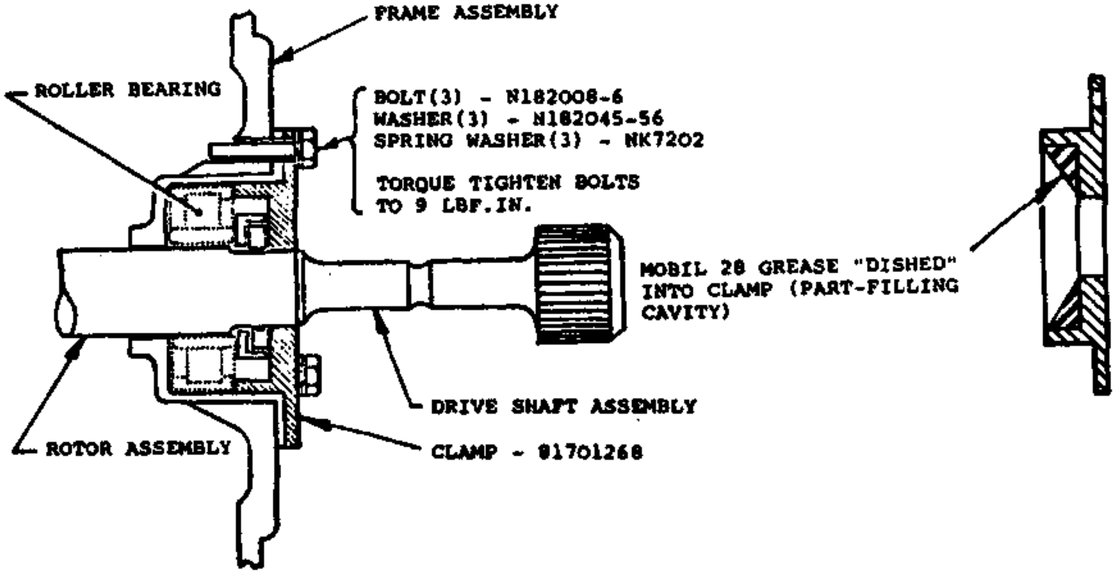
Equipment and materials required :-

| | |
|---|---|
| Grease | Mobil 28 |
| Spring washers | NK7202 |
| Torque spanner | 9 lbf.in. |

(1) Remove a.c. generator (see para.2.A.).

(2) Remove the three bolts securing clamp. Retain plain washers but discard spring washers.

(3) Withdraw securing clamp from frame assembly. The clamp will be loosely retained on the shaft by the splines.



Drive end bearing details
Fig.201

(4) Remove visible grease in roller bearing cavity and replace with same amount of fresh grease. Under no circumstances is cavity to be overfilled.

(5) Remove grease from clamp and replace with fresh grease, only part filling as indicated.

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...AC generator - Maintenance practices continued

(6) Refit clamp and secure with bolts, plain washers and new spring washers.

(7) Torque tighten bolts to 9 lbf.in.

(8) Install a.c. generator (see para.2.C.).

## 2. Removal/Installation

Equipment and materials required :-

| | |
|---|---|
| Grease .. .. .. | DTD 5617, Optimoly paste PL, Moly Paul GP 109, Rocol MT-LM or any grease quoted in Garrett Airesearch Maintenance Manual. |
| Approved clean engine oil | |
| Torque spanner .. .. | 110 lb.in. |

### A. Remove a.c. generator

(1) Isolate relevant electrical supplies by tripping appropriate circuit breaker or by removing fuse (see Chapter 24, GENERAL).

(2) Open engine cowl and lower access door.

(3) Disconnect generator electrical connector.

(4) CAUTION : GENERATOR WEIGHS ABOUT 20 LBS.

Support weight of generator, release V-Clamp and withdraw generator complete with cooling air intake.

(5) If replacement generator is to be fitted, remove securing clip and cooling air intake (wire mesh dome). Fit covers to generator electrical connector and apertures, to prevent ingress of foreign matter, and tape generator drive shaft splines for protection in transit.

### B. Checks/Tests before installation

(1) Ensure that all generator covers for protection and transportation are removed.

(2) If applicable, fit cooling air intake to generator with peg and cut-out aligned, and secure with clip so that clip screw is located for accessibility (see Fig. 202).

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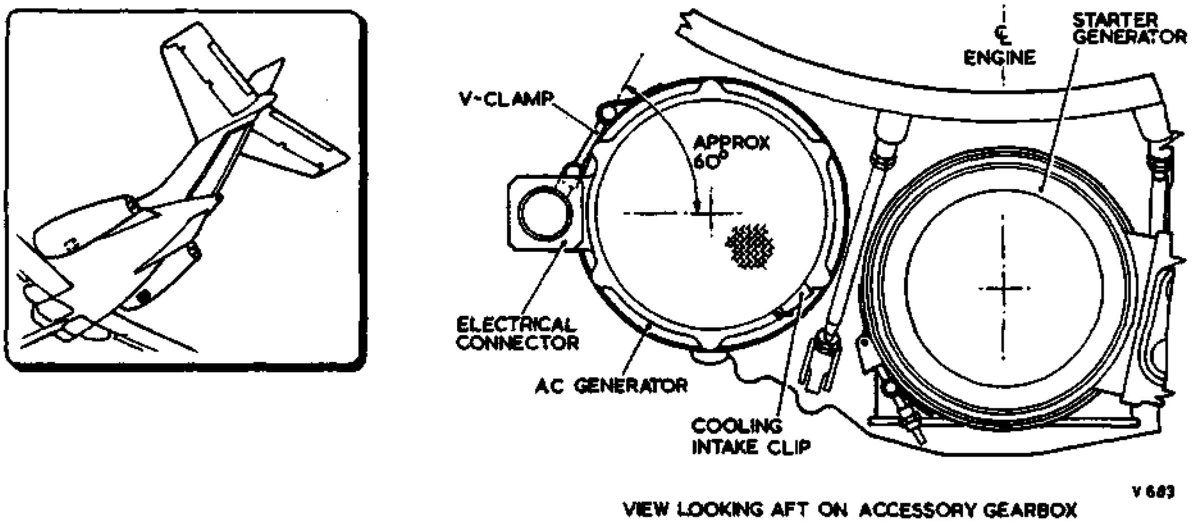
...AC generator - Maintenance practices continued

(3) Examine generator drive shaft splines for cleanliness, evidence of excessive wear and damage, and rotate drive shaft for freedom of movement.

(4) Ensure that generator mounting flange and V-clamp contact surfaces are clean and free from damage.

C. Install a.c. generator

(1) Lubricate drive shaft splines with grease.



Installation of a.c. generator
Fig.202

(2) Check the quick attach-detach (QAD) adapter for loose mounting against engine. If necessary, lubricate securing nuts with clean approved engine oil and torque load nuts to 100-110 lb.ins.. Also ensure that QAD adapter mounting flange and clamping surfaces are clean and free from damage.

(3) Smear the inside mating faces of generator V-clamp with clean grease and locate clamp on generator.

...AC generator - Maintenance practices continued

(4) CAUTION : KEEP GENERATOR FLUSH UP AGAINST QAD ADAPTER DURING INSTALLATION AND DO NOT PERMIT UNIT TO HANG LOOSELY OR WITHOUT V-CLAMP BEING FULLY TIGHTENED. OTHERWISE UNDUE BENDING FORCE ON DRIVE SHAFT CAN RESULT IN DAMAGE AND IN-FLIGHT FAILURE.

Supporting weight of generator, offer machine into engine accessory gearbox drive until fully engaged and flush up against the QAD adapter.

(5) With generator positioned as shown on Fig.202, fit V-clamp over mating flanges and torque-tighten clamp to 70-90 lb.ins. Loosen clamp nut 1/2 turn and re-torque to 70-90 lb.ins.; repeat sequence until clamp bolt cases to advance.

(6) Connect and secure generator electrical connector.

(7) Close and secure engine cowl lower access door and check generator(s) cooling outlet for alignment with cowl.

(8) Reset circuit breakers or fuse as appropriate (see para. 1.A.(1)).

(9) Functionally test generator circuit (see Chapter 24, RANDOM FREQUENCY WINDSHIELD POWER SYSTEM).

* * *

## DC GENERATION - DESCRIPTION AND OPERATION

(Without cold start or 3rd battery)

### 1. Description

### A. General

NOTE : The integration of starting and generating functions and interlocking circuitry makes a degree of circuit description unavoidable in both engine starting and d.c. generation chapters. To minimise duplication, the starting function is described here only in so far as it supports understanding of the overall generating function. For detailed description and operation see Chapter 80, STARTING - GENERAL.

Two identical, engine-driven, dual purpose, starter generators are employed with their associated control components to function initially in an engine starting mode and, when this mode is satisfactorily completed, to provide d.c. electrical power at 28 volts 16.8 kW (8.4 kW per generator) to operate the d.c. electrical services.

Distribution of this power is effected through a busbar arrangement which can be split, or integrated, through a switched bustie contactor. The d.c. generating and busbar arrangement is shown schematically on Fig.2.

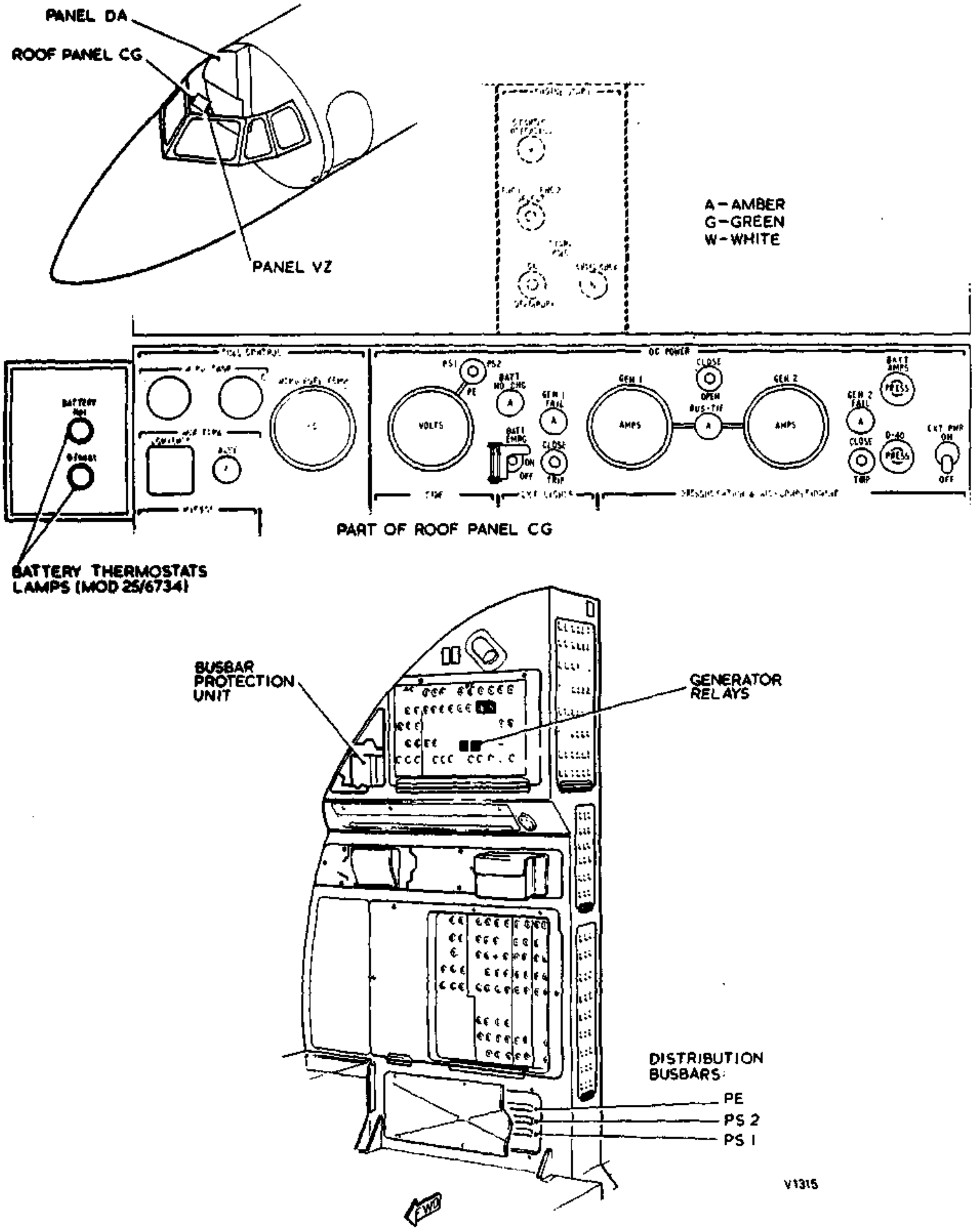
The main busbars, designated PS1 and PS2, can be split or tied to enable individual, or paralleled generator system functioning, as necessity dictates. Normally, paralleled generator mode of operation would be employed, although the output of one generator, with busbars tied, can support the essential electrical requirements up to a load of 300 amps.

Busbars PS1 and PS2 supply the major (non-essential) loads and also feed, through blocking power diodes, an essential services busbar, PE, and its extension, PE2. The blocking diodes prevent feed-back from PE to PS1 and PS2 in emergency circumstances. PS1 and PS2 also provide charge current for two main aircraft batteries, No.1 and No.2, which, when the generators are on line, are floating across the busbars.

Batteries No.1 and No.2 are connected to busbars PS1 and PS2, respectively, through battery contactors, the control circuits of which are interlocked electrically with the generator line contactors in a manner such that the batteries are isolated from the non-essential services when the generators are off line. To assure supplies to the essential services in the latter instance, batteries No.1 and 2 are connected to busbar PE via individual contactors (emergency) the control circuits of which are duplicated in emergency conditions.

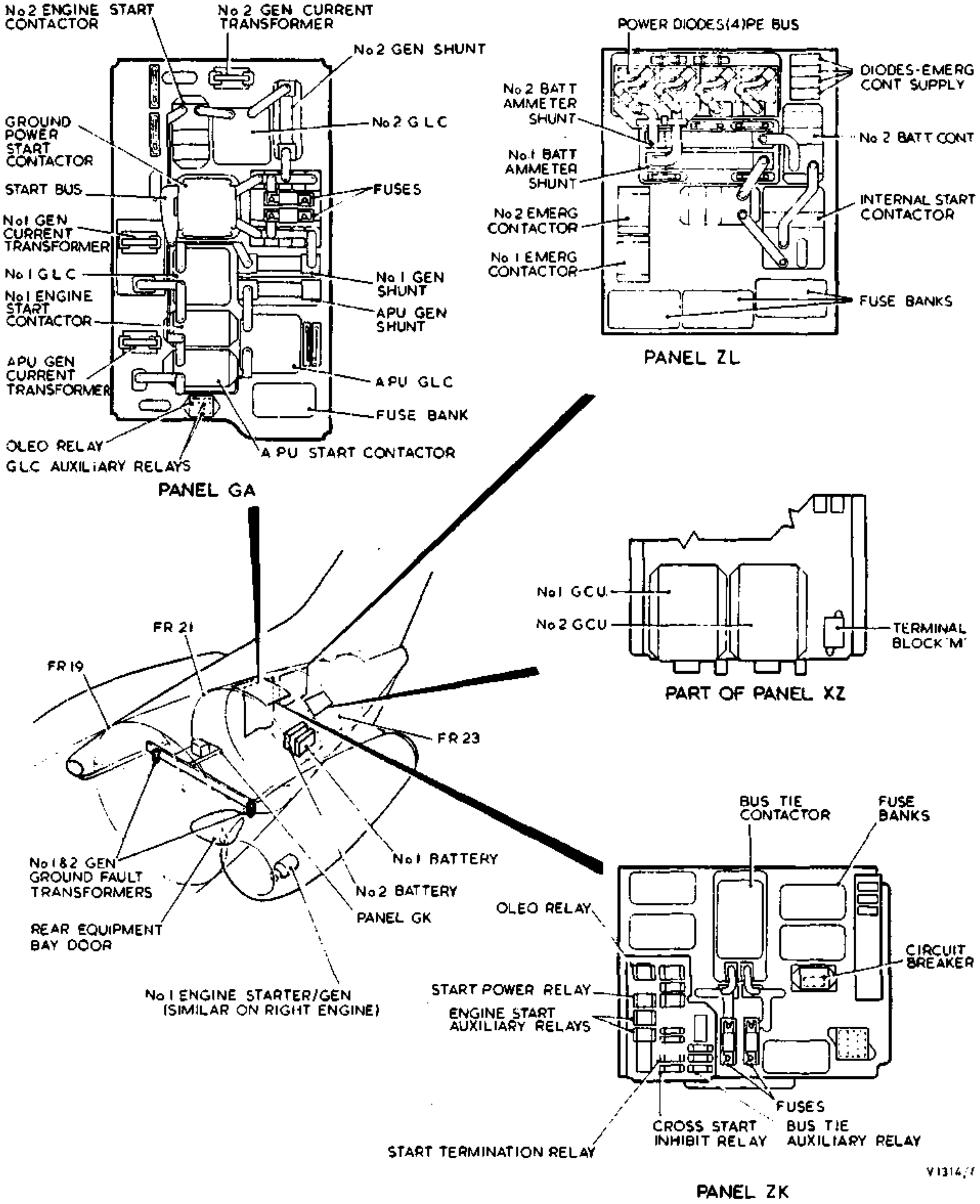
An auxiliary power unit (a.p.u.) having its own starter/generator, generator control unit and switching circuitry can be installed in the rear equipment bay. The generator is capable of providing all d.c. requirements on the ground giving independence from ground power sources. However, to permit operation from an external supply source, a three pin plug is fitted in the fuselage right side.

...DC generation - Description and operation continued



DC generation - location of components
Fig.1 sheet 1

...DC generation - Description and operation continued



DC generation - location of components
Fig.1 sheet 2

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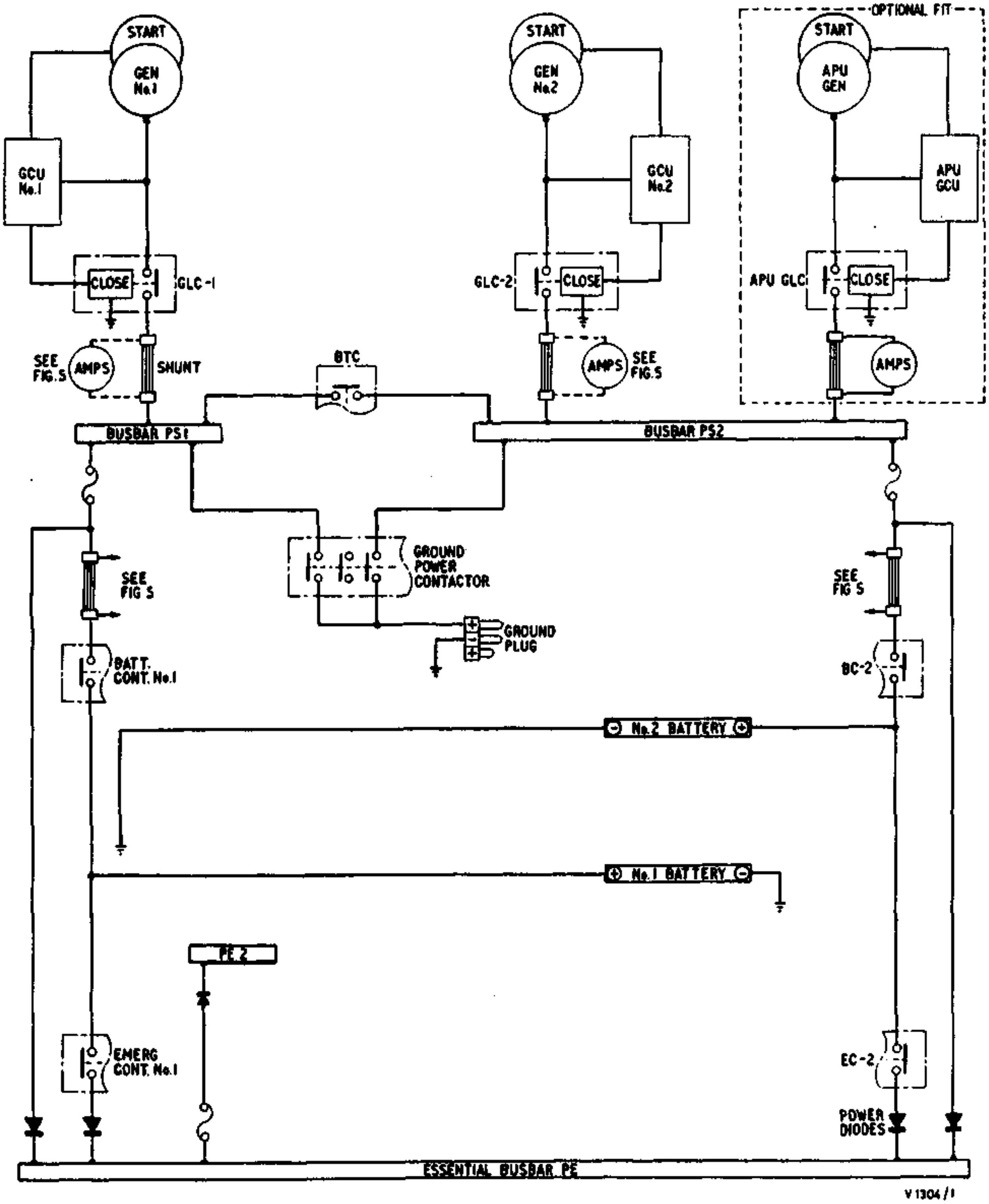


DC generation system - schematic diagram
Fig.2

...DC generation - Description and operation continued

The transition from engine start to generating mode is accomplished automatically, by relay control, effected by a signal from the starter/generator speed pick-up tacho-generator. Should this cut-off signal be inoperative, the start sequence can be terminated by using a START PWR ON-OFF/ABORT switch on the pilots roof panel CG. As a generator, the machine is self-excited and cooling is by an integral centrifugal fan and ram air.

B. System control (see Fig.3)

At engine start initiation, the generator control unit (g.c.u.) receives a signal to ensure that the auto-field latch relay (KFR) is reset, and thereby completing the starter/generator field circuit. During engine start, the g.c.u. field weakening regulation circuit (voltage regulator locked-out) will maintain starter current control throughout the starting cycle to provide optimum acceleration for the engine. Starter cut-off is signalled by the g.c.u., derived from the starter/generator speed pick-up tacho at 5500 rev/min. After cut-off, the g.c.u. field weakening regulator is de-energized and the standard voltage regulator will gain control of its field power amplifier to build-up the generator voltage.

The generator will automatically come 'on-line' without selection, when the quality of electrical power as monitored by the g.c.u. is correct, provided the engine start and ground power inhibit circuits are de-energized. The g.c.u. incorporates voltage differential and reverse current sensing circuits which control the operation of the generator line contactor (g.l.c.). When the generator voltage at the g.l.c. is 0.3 volt or less than the busbar voltage, the g.l.c. closes and reverse current sensing becomes operative. The g.l.c. main contacts connect the generator output to PS and PE busbars and its auxiliary contacts change over to :-

(1) Energize the battery contactor and connect the relevant battery to its charge and indication circuits.

(2) Complete the bustie contactor coil supply circuit to its BUSTIE switch, which, when set to CLOSE, will link PS1 and PS2 busbars.

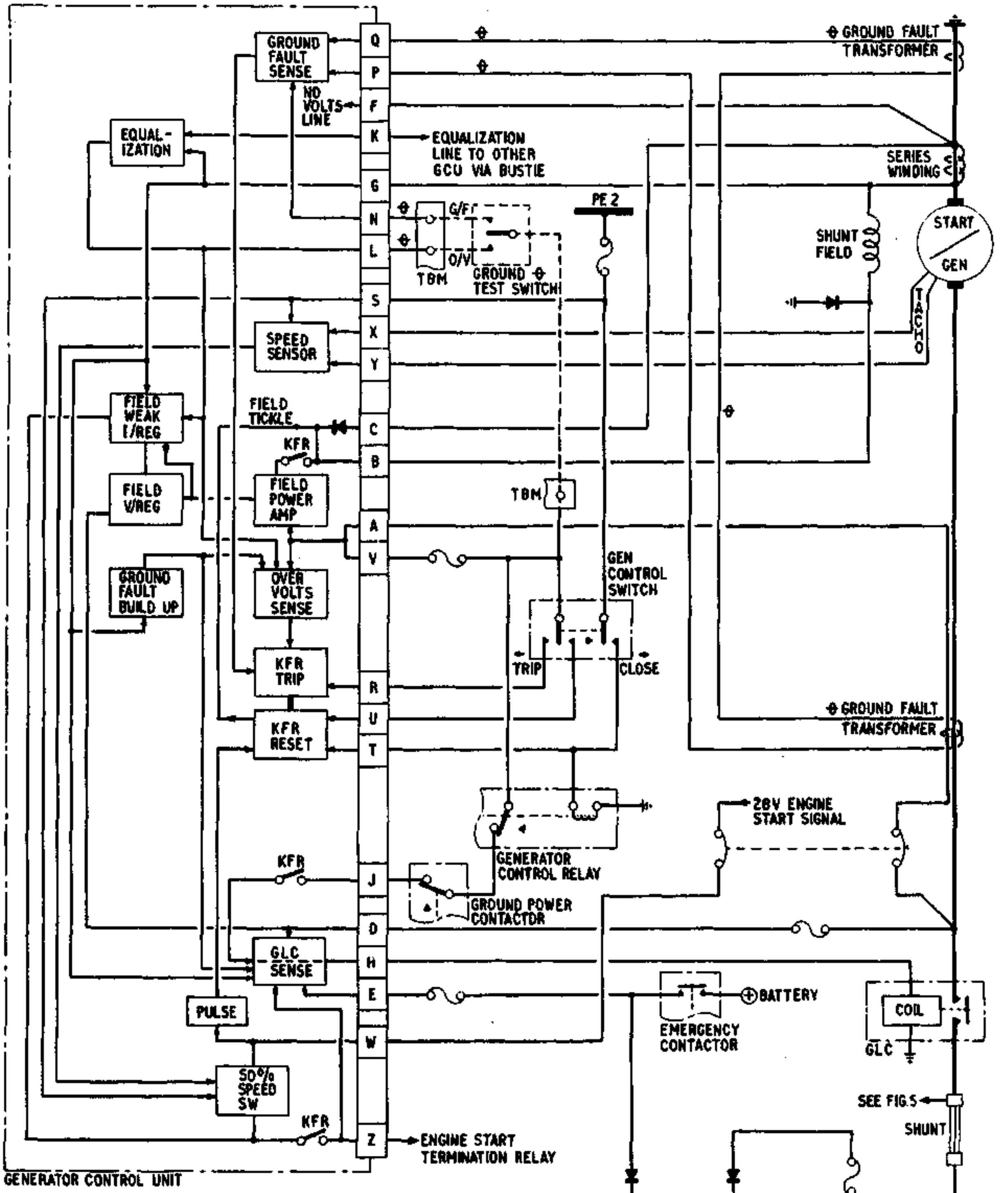
(3) Extinguish the GENerator FAIL lamp.

Manual control of each generator's output to the busbars is provided by a switch labelled GEN CLOSE-TRIP on the pilots roof panel CG. If the g.c.u. field latch relay (KFR) has been tripped, or the generator output fails to build up, selecting the GEN switch to CLOSE position (momentary) will connect a supply to :-

(1) Excite the generator field tickle from busbar PE2, to promote correct polarity and sufficient residual voltage for build-up of generator output voltage.

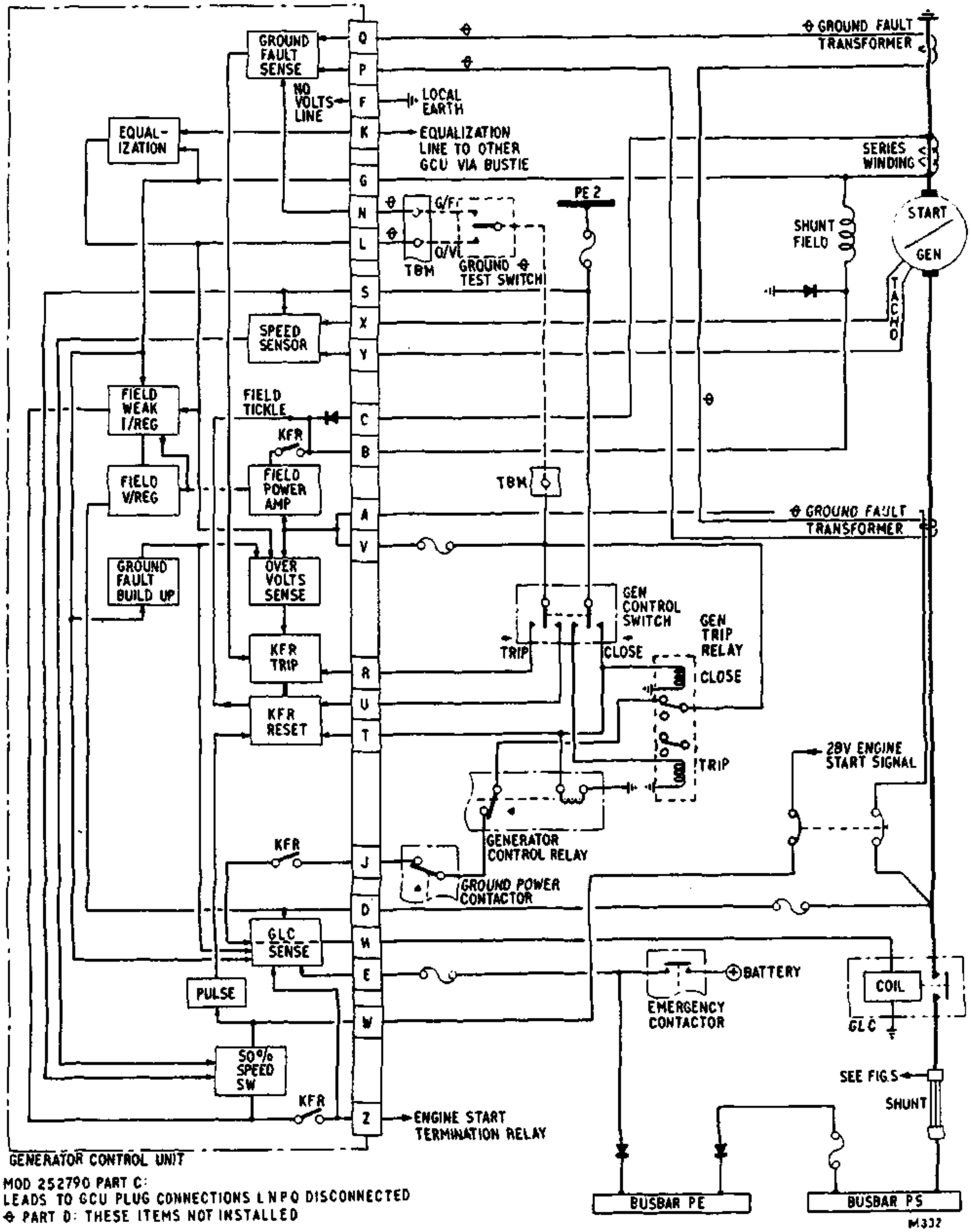
(2) Energize and reset the g.c.u. field latch relay (KFR).

...DC generation - Description and operation continued



MOD 252790 PART C:
LEADS TO GCU PLUG
CONNECTIONS L.N.P.Q.
DISCONNECTED. ⊖ PART D:
THESE ITEMS NOT INSTALLED.

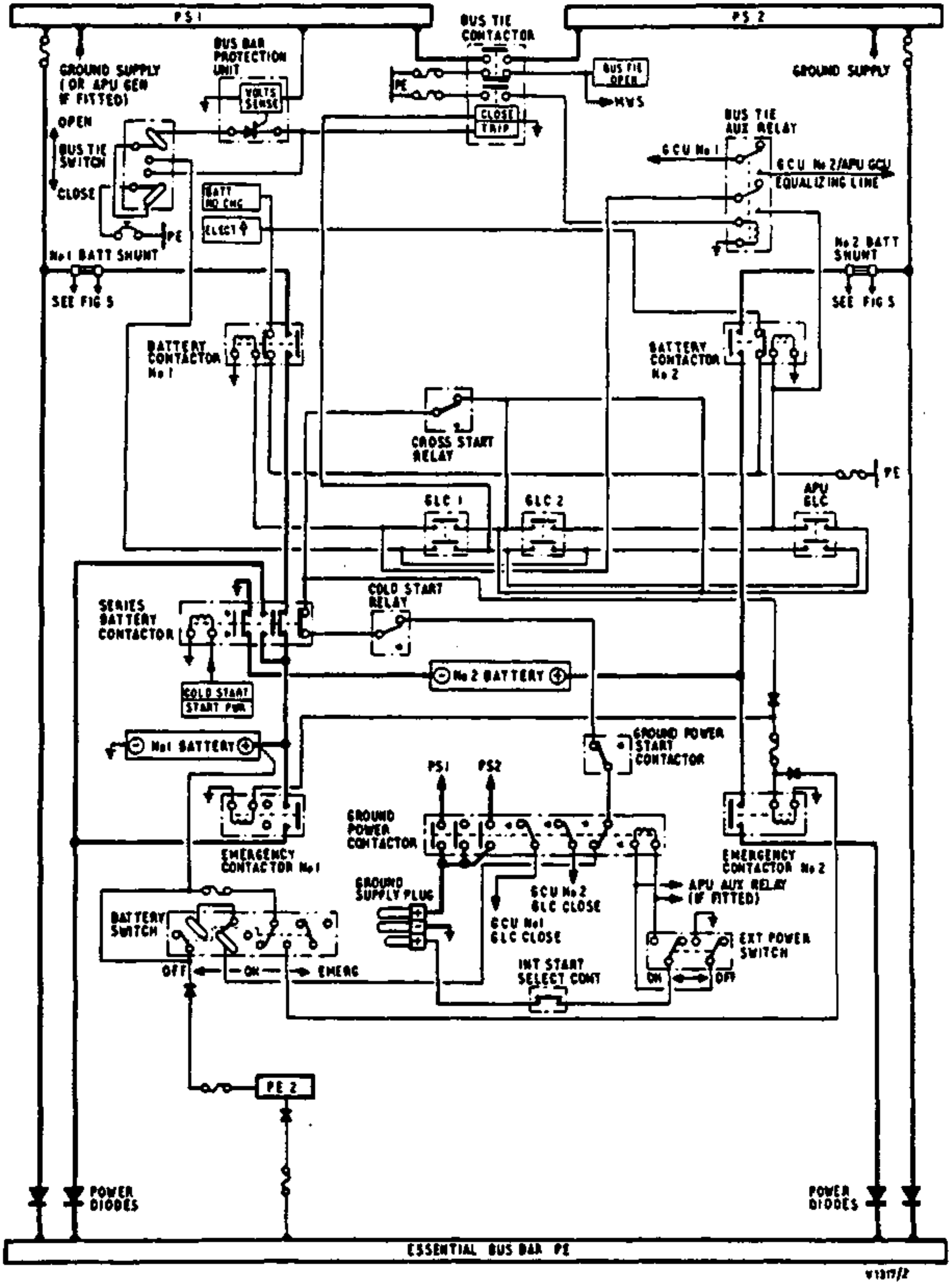
DC generator and control unit - schematic diagram
Fig.3



MOD 252790 PART C:
LEADS TO GCU PLUG CONNECTIONS L N P Q DISCONNECTED
⊖ PART D: THESE ITEMS NOT INSTALLED

DC generator and control unit (Mod.253267) - schematic diagram
Fig.3a

...DC generation - Description and operation continued



Busbar and battery supply switching circuit
Fig.4

(3) Energize a generator control relay which inhibits the GLC (until switch is released) and prevents a generator output being fed on to a possible busbar fault.

When the generator is 'on-line', operating the GEN switch to its TRIP position (momentary) connects a supply from its GLC to energize the field latch relay trip coil, which then opens the GLC to disconnect the generator from the busbar and de-excite the generator output to residual voltage.

Mod.253267 Moving the GEN control switch to TRIP also energizes the trip coil of the generator trip relay. This isolates the generator output from the PS busbar by removing power from the GLC coil and opening the contacts. The loss of the earth connection at pin F on Lear Seigler GCU's makes the voltage control circuitry inoperative. An overvoltage which can result from this fault may lead to battery overheat and damage to avionic and other equipment. The earth connection is moved from the starter/generator earth stud to the engine mounting beam, which improves the integrity of the earth connection and the necessity to disconnect the earth wire when the starter/generator is removed.

All aircraft The GCU contains the control circuit functions for regulation, sensing and protection of a d.c. generating system, and in addition, provides field weakening for starter control with automatic cut-off. These features are briefly summarized as follows:

(1) Field weakening starter control
Field weakening regulator compares starter/generator interpole voltage with reference voltage. At engine start, the regulator maintains a full field on the starter and locks out the generator voltage regulator. When engine self-sustaining speed is reached the starter's armature current tends to fall (sensed at interpole winding) and the field weakening regulator reduces field excitation to cause an increase in armature current and so effectively produce a constant current to optimize acceleration up to starter cut-off.

(2) Automatic starter cut-off
The starter/generator magnetic pick-up speed sensor connects a signal to the GCU. At 5500 rpm the field weakening circuit is de-energized and the generator voltage regulator gains control of the field power amplifier and begins to build up generator voltage. The starter circuit is inoperative until the field circuit is closed. Application of power to pin W of the GCU with 28 volts at pin S closes the field circuit (contactor KFR reset).

(3) Field relay (KFR)
The field and start lines are switched by a field latched relay (KFR) which forms an integral part of the GCU When a start signal is applied to pin W of the GCU the relay is pulsed, by solid state switching, to reset the contacts to a closed position and, providing a supply is available at pin S, a supply is available at pin Z to initiate the start sequence. The relay also off-loads the generator on receipt of signals from the ground fault and overvolt sense circuits.

(4) Voltage regulator
Compares generated output voltage with a reference voltage, and the difference is used to control the field power amplifier which adjusts the generator's shunt field excitation.

(5) Paralleling

When both generators are connected in parallel, an equalizing circuit is completed between generators and control units. Each g.c.u. compares its generator interpole winding voltage with that of the other generator, and the equalizing circuit attempts to adjust the equalizing line difference to zero. Any difference voltage is amplified and fed back to the voltage regulator, to adjust generator output voltages, so that the busbar loads are equalized between generators.

(6) Overvoltage protection

The overvoltage sensing amplifier compares generator voltage with a reference voltage. When the generator voltage rises to 32.5 volts the field latch relay (KFR) is tripped to :-

(a) De-energize the g.l.c. and isolate the faulty generator from the busbar.

(b) Activate the c.a.g.s. (see Chapter 33, CENTRAL ATTENTION GETTING SYSTEM) and light the GENerator FAIL lamp.

(c) Open-circuit the generator field, and de-excite the generator output to residual voltage.

(d) Disconnect the equalizing circuit.

(7) Ground fault protection

Feeder fault protection between generator and g.l.c. is provided during:-

(a) Build-up of generator output when g.l.c. is open (generator off-load).

(b) Generator operation when g.l.c. is closed (generator on-load).

During build-up of generator output (g.l.c. open) voltage detected across the generator interpole winding is low. If an earth fault exists between generator and g.l.c. the generator output would feed fault, the voltage across the interpole winding would rise in proportion to current flow, and when equal to half of generator total load current rating, the g.c.u. sensing circuit will inhibit the g.l.c. close circuit and trigger the overvoltage silicon-controlled rectifier (s.c.r.). The s.c.r. conducts to energize the field latch relay (KFR) trip coil and de-excite the generator output to residual voltage.

When a generator is in operation with the g.l.c. closed (generator on-load) two current transformers, one sensing current change at g.l.c., is compared with the other sensing current change at generator earth return. When differential current is sensed (earth fault) between transformers, a separate s.c.r. will be triggered to trip the generator field latch relay (KFR), interrupt the g.l.c. close circuit and de-excite the generator output to residual voltage.

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...DC generation - Description and operation continued

(8) Over-excitation protection

When generators are operating in parallel, if one generator voltage regulator is unable to properly control its generator output, a condition may arise where one generator becomes over-excited and attempts to supply all the system loads. The remaining good generator channel will act as load, and therefore, the busbar voltage should remain normal with a tendency to slightly increase. The over-excitation circuit will detect this condition when the generator interpole voltage reaches 0.23 volts or more with the busbar at or above 28.5 volts. The faulty channel will receive a de-excitation signal from the equalizing circuit because it is carrying all the load, and consequently, an input signal is fed to the overvoltage circuit to trigger its s.c.r. and trip the generator field latch relay (KFR) to interrupt the g.l.c. close circuit and de-excite the generator output to residual voltage.

(9) In-situ testing for overvoltage and ground fault circuits (pre Mod.252790 'C' & 'D')

Provision to test overvoltage and ground fault protection circuits contained in No.1 and No.2 generator control units is provided by wiring from each g.c.u. to a terminal block coded M, located alongside the control units on panel XZ. Testing, necessitates connecting a suitable test switch to the appropriate terminal block connections. When the generator is 'on-line', test switch operation will connect a g.l.c. supply to operate the protection circuits.

The main busbars PS1 and PS2 are tied together by a mechanical latch contactor controlled electrically by 'close' and 'open' operating coils. The coils are energized by a BUSTIE switch selection, and the 'open' coil is also energized automatically during abnormal conditions from a busbar protection unit. The BUSTIE switch on the pilots roof panel CG is a two-pole 3-position rocker switch. Its CLOSE and OPEN positions are momentary, and therefore, when the operating force is removed, the switch reverts to its central position. Selection of the BUSTIE switch to its OPEN position will trip the latch contactor and its main contacts will open to separate busbars PS1 and PS2. The contactor auxiliary contacts change over to light the BUSTIE lamp, complete the contactor 'close' coil circuit and de-energize the bustie auxiliary relay. The relay contacts relax to inhibit the equalizing line circuit and break the paralleled battery contactor coil supply. When a g.l.c. is closed (generator on-line) selecting the BUSTIE switch to CLOSE, will energize the bustie contactor close coil and its main contacts close to link busbars PS1 and PS2. The contactor auxiliary contacts change over to extinguish the BUSTIE lamp, complete the contactor 'open' coil circuit and energize the bustie auxiliary relay; the relay contacts change over to reinstate the equalizing line circuit, and parallel the battery contactor coil supply.

The busbar protection unit senses PS1 busbar voltage, and opens the bustie contactor automatically when the voltage rises to 29.5 ± 0.5 volts, or falls to 24.5 ± 0.5 volts. The protection unit is fully transistorized and incorporates under and overvoltage sensing circuits and includes a time delay function to prevent the unit from operating during transient conditions. An output from either sensing circuit will trigger a uni-junction transistor, which drives the output s.c.r. into the conducting state and permits a supply from busbar PE to energize the bustie contactor 'open' coil.

C. Batteries

Two main batteries (No.1 and 2) are installed in the rear equipment bay and maintain d.c. supplies to the essential services in the event of failure of the generating systems. The batteries also provide electrical power for engine starting, in the absence of a ground supply. Each main battery is fitted in a drip tray, secured to the main tray assembly by wing bolts. Ventilation of battery gas to atmosphere is accomplished by plastic pipes extending from the front of the battery to an outlet positioned below the main inverter compartment. When Mod.25/6734 is incorporated, the existing main aircraft lead acid batteries are replaced with nickel-cadmium batteries plus temperature sensing and warning circuits. Each battery has integral hot (57°C) and overheat (70°C) thermal switches, which, when operated, light associated BATTery HOT (amber) and BATTery O/HEAT (red) lamps on the flight compartment roof panel CG; an input is also fed into the c.a.g.s. (see Chapter 33, CENTRAL ATTENTION GETTING SYSTEM).

NOTE : The minimum permissible battery temperature for take-off in order to meet emergency flight time is -10°C. The emergency flight time for batteries is calculated at -20°C, the 10°C difference is due to further cooling in flight.

To assure the functions of No.1 and No.2 batteries, separate battery contactors and emergency contactors are utilized. Each battery contactor is interlocked with the g.l.c. and engine start circuits, and ensures that the associated battery is charge-supported from a generator-powered busbar, and does not support the non-essential busbar PS on its own. Whenever a battery contactor is de-energized, a supply from PE busbar is connected through a set of its relaxed auxiliary contacts to light the BATT NO CHG lamp on the pilots roof panel CG and an input is fed into the c.a.g.s. The emergency contactors connect No.1 and No.2 batteries individually to busbar PE to power the emergency services. This arrangement ensures that a single fault does not prevent both main batteries from supplying the emergency services.

Essential busbars PE and P2 are battery-supported and are controlled by a red, baulked, rocker switch, labelled BATTERY EMERG-ON-OFF on the pilots roof panel CG. With batteries only connected, operating the BATTERY switch to ON will connect a supply direct from No.1 battery through the relaxed auxiliary contacts of the ground supply contactor and ground supply start contactor to :-

(1) Energize the emergency contactors through engine start interlocks, and connect the outputs of No.1 and No.2 batteries through power rectifiers to energize busbars PE and PE2.

...DC generation - Description and operation continued

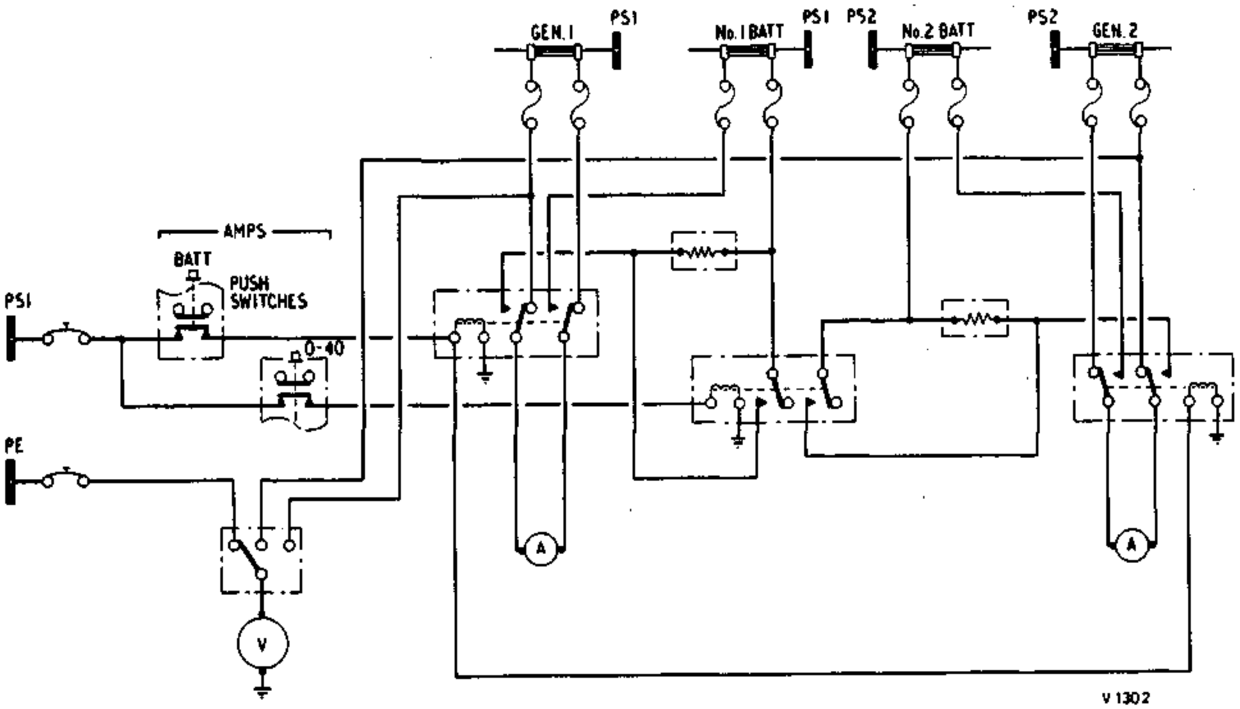
(2) Make power supplies available at engine start controls.

The BATTERY switch in the EMERG position, will connect a supply direct from No.1 battery to energize both emergency contactors via a circuit diode. The contactors main contacts close and individually connect No.1 and No.2 batteries to the essential busbar PE through power diodes.

D. Ground power

External d.c. ground supplies are connected to the aircraft busbar system via a three-pin plug located on the right side of the fuselage. From the ground supply plug, power is routed to the d.c. busbars through a ground power contactor (g.p.c.) and then to the start busbar through the ground power start contactor (g.p.s.c.). The g.p.c., g.p.s.c. and an auxiliary ground power relay (see Chapter 24, APU GENERATION) are controlled by the EXT POWER switch on the pilots roof panel CG.

When external ground power is connected and the EXT POWER switch selected ON, a 28-volt supply from the small pin of the ground supply plug energizes the coils of the g.p.c., g.p.s.c. and auxiliary relay, via the internal start select contactor and one pole of the EXT POWER switch. The g.p.c. and auxiliary relay coil earth returns are completed through the second pole



Generator and battery ammeter and voltmeter monitoring circuits
Fig.5

of the EXT POWER switch, to effect closure of contactors and relay. The contactor main contacts close and connect ground supplies to PS1 and PS2 busbars which subsequently energizes the essential busbar PE. The g.p.c. auxiliary contacts change over to inhibit No.1 and No.2 generator line contactors, light the START PWR AVAILABLE lamp and isolate the aircraft internal batteries. Therefore, before the aircraft engine-driven generators No.1 and No.2 can come on-line and connect their outputs to the busbars to complete the aircraft internal battery charge circuits, the EXT POWER switch must be set to OFF.

### E. Power indication

Two ammeters mounted on the pilots roof panel CG, display No.1 and No.2 generator load current. The ammeter display can be converted to indicate No.1 and No.2 batteries charge current by operating a push switch annotated BATT AMPS on panel CG. A second push switch, labelled 0-40, enables the batteries charge current to be more accurately monitored when the charge current falls below 40 amps.

During normal operating conditions, each ammeter is connected across its associated generator shunt, to display generator load current.

When the BATT push switch is operated, the associated relays are energized (Fig.5), to disconnect the generator shunts and connect the battery shunts, via the operated relay contacts and scaling resistors, to use the dual ammeter f.s.d. of 0-300 amps.

Provided the ammeter readings fall below 40 amps, the 0-40 push switch can be operated in addition to the BATT push switch, to energize the scale change relay. The relay contacts change over, short circuit the scaling resistors, and convert the ammeters f.s.d. from 0-300 amps to 0-40 amps.

When the BATT and 0-40 push switches are released, the ammeter circuit relays de-energize, and the ammeter displays revert to monitoring No.1 and No.2 generator load current.

A voltmeter and associated selector switch labelled PS1-PE-PS2, enable a check to be made on the availability of battery and busbar power supplies.

The ammeters and voltmeter are integrally illuminated, the intensity of illumination is controlled by a dimmer switch labelled OVHD/SIDE & PEDESTAL on the pilots roof panel CG.

## 2. Operation

At engine start initiation, the g.c.u. field latch relay (KFR) is pulsed by a reset signal through the operated contacts of the ENG 1/ENG 2 SELECT switch to ensure that the starter/generator field circuit is complete. When the g.c.u. senses a signal from the starter/generator speed pick-up tacho proportional to 5500 rev/min turbine speed, the supply to the engine start termination relay is interrupted.

The start termination relay, when de-energized, also de-energizes the start power and engine start contactor to disconnect the starter busbar supplies.

The g.c.u. starter cut-off speed sensor circuit also de-energizes the field weakening current regulation, and the voltage regulator regains control of the field power amplifier.

As the generator voltage rises, its control unit g.l.c. sensing circuit, compares the generator and busbar voltages. When the generator voltage differential is 0.3 volt or less, a supply from the g.l.c. is routed via the relaxed contacts of the series battery auxiliary relay, generator relay and ground power contactors to energize the g.l.c. operating coil from its g.c.u. sensing circuit. The g.l.c. main contacts close and connect the generator output to power PS and PE busbars. The g.l.c. auxiliary contacts change over to :-

(1) Energize the related battery contactor and connect the relevant battery to its charge and indication circuits.

(2) Extinguish the GENerator FAIL lamp.

(3) Complete the bustie contactor coil supply circuit.

With both generators 'on-line', each generator output is connected to the split busbar system PS1 and PS2. Operating the BUSTIE switch to CLOSE will energize the bustie contactor from busbar PE, through the operated generator line contactor(s) auxiliary contacts. The bustie contactor main contacts close to tie PS1 and PS2 busbar together and its auxiliary contacts will extinguish the BUSTIE lamp and complete the equalizing circuit through its auxiliary relay.

If a generator output falls, reverse current will flow from busbar to generator. The voltage reference at the generator interpole winding will fall to switch off the g.l.c. sensing circuit and break the g.c.u. equalizing circuit. The g.l.c. will be de-energized and disconnect the generator from the busbar. With one generator failed, and provided that the total load current does not exceed 300 amps, the remaining serviceable generator channel can supply the busbar system. If load current is excessive, reduction is effected by switching off non-essential services.

## A. Abnormal conditions

Development of a feeder fault between generator and g.l.c. or generator over-excitation or overvoltage is detected by the control unit (g.c.u.) sensing circuits. The g.c.u. field latch relay trip coil is energized automatically and de-excites the generator output to residual voltage.

Re-setting of a generator when its g.c.u. field circuit relay has been tripped, is achieved by setting the GEN switch to the CLOSE position (momentary). The GEN switch connects a reset signal from PE2 supply to operate and close the g.c.u. field latch relay, and connects a generated supply from the g.l.c. to energize the generator control relay to inhibit the g.l.c. and prevent a generator output being fed on to a busbar fault. Releasing the switch will allow the g.l.c. circuit to function and connect the generator to busbar.

If protection circuits fail to isolate a faulty generator channel from the busbar automatically, disconnection is effected by manually selecting the GEN switch to its TRIP position (momentary). In the TRIP position the generator output at the g.l.c. is connected to trip the g.c.u. field latch relay (KFR) and de-excite the generator output to residual voltage.

When busbars PS1 and PS2 are tied together, the busbar protection unit senses PS1 busbar for under and overvoltage. If the busbar voltage rises to 29.5 ± 0.5 volts or falls to 24.5 ± 0.5 volts the protection unit output silicon-controlled rectifier (s.c.r.) is switched 'on' and connects PE supply through the BUSTIE switch in its central position to energize the bustie contactor 'open' coil. The bustie contactor main contacts open to isolate the faulty generator channel from the serviceable generator channel. If the under or overvoltage condition is corrected, the busbar protection unit s.c.r. will require re-setting by selecting the BUSTIE switch to CLOSE.

With external ground supplies connected and the EXT PWR switch at ON, the ground supply contactor and ground supply start contactor are energized. The ground supply contactor connects ground power to busbars PL1 and PL2, and the ground supply start contactor connects the start busbar to PS1 and PS2. The auxiliary contacts of the two contactors are connected in series and when operated inhibit the g.l.c. contactors, internal start facilities and isolate the main batteries.

* * *

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# DC GENERATION - MAINTENANCE PRACTICES

## 1.General

Subsequent to any equipment removal/installation or other disturbance of the DC Generation System, a function test of the system must be performed.

## 2.Adjustment/Test

### A.Functionally test d.c. generation system

NOTE: The following tests of the d.c. generating system, includes emergency contactor control for individual supply circuits. If it is desired to check only the emergency contactor control circuits, effect operations (1) and (17) to (24) inclusive.

(1) Ensure that all aircraft batteries are correctly fitted and connected.

(2) Set BATTERY selector switch ON, and check that the d.c. voltmeter indicates battery voltage when the voltmeter selector switch is set to PE, and indicates zero when PS1 and PS2 is selected. Also check that No.1 and No.2 GENerator FAIL, BATT NO CHG and BUSTIE OPEN lamps are lit and the c.a.g.s. (see Chapter 33, CENTRAL ATTENTION GETTING SYSTEM) lamps are flashing. Cancel flashing lamps.

(3) Set EXT POWER switch to ON, connect and switch on external ground supply (see Chapter 12, SERVICING - ELECTRICAL POWER). Check that No.1 and No.2 GENerator FAIL, BUSTIE and BATTERY NO CHG lamps are lit and the c.a.g.s. lamps are flashing. Check that voltmeter indicates external ground supply voltage when connected to each busbar, in turn. Cancel flashing lamps.

CAUTION : FOR ENGINE STARTING, IT IS ESSENTIAL THAT EXTERNAL GROUND POWER SUPPLIES BE LIMITED TO AN OUTPUT RATING OF 1100 AMPERES, TO REDUCE THE EFFECT OF DAMAGE TO STARTER/GENERATOR BRUSH GEAR.

(4) Start No.2 and No.1 engines in that order (see Garrett AiResearch TFE 731 Maintenance Manual Chapter 72).

(5) Set EXT POWER switch to OFF. Check that No.1 and No.2 GENerator FAIL and the BATTERY NO CHG lamps are not lit and the BUSTIE lamp is lit. Switch off and disconnect external supply.

(6) Switch on various loads connected to busbar PS1 and PS2 (that is both main inverters etc). Check that voltmeter registers approx 28V (generated output) for each busbar and check ammeters indicate No.1 and No.2 generator load current.

(7) Select the BUSTIE switch to CLOSE, and ensure that the BUSTIE lamp is unlit. Check each generator load current displayed on the dual ammeter, and ensure that the difference in current level does not exceed 10% of the mean current.

(8) Operate BATT push switch and check battery charging current. When the dual ammeter indications fall below 40A, additionally operate the 0-40A switch and check that dual ammeter indicates No.1 and No.2 battery charging current.

(9) Release BATT and 0-40A switches and check the dual ammeter indicates No.1 and No.2 generator load current.

(10) Ensure that the total load on the busbar system (that is the sum of the ammeter readings) is less than 300A. Select GEN 1 switch to TRIP. Check that GEN 1 FAIL lamp is lit, the c.a.g.s. lamps are flashing, the associated ammeter reading drops to zero and the other ammeter rises to indicate total load current. Cancel flashing lamps.

(11) Select BUSTIE switch to OPEN. Check that BATT NO CHG, INV 1 FAIL and BUSTIE OPEN lamps are lit and the c.a.g.s. lamps are flashing. With voltmeter selector switch set to PS1 check that voltmeter indicates less than 5 volts. Cancel flashing lamp.

(12) Select BUSTIE switch to CLOSE. Check that BATT NO CHG and BUSTIE lamps are not lit, and the ammeter reads load current.

(13) Select INV 1 switch to START. Check that INV 1 FAIL lamp is not lit.

(14) Select GEN 1 switch to CLOSE. Check the GEN 1 FAIL lamp is not lit and the ammeters are indicating load sharing as detailed in operation (7).

(15) Substituting No.2 for No.1, repeat operations (10) to (14) for No.2 generator and distribution system.

(16) Select the BUSTIE switch to OPEN. Check the BUSTIE OPEN lamp is lit and the c.a.g.s. lamps are flashing.

(17) Switch off various loads selected in operation (6).

(18) Run down No.1 engine (Chapter 71, GENERAL). Check that No.1 GENerator FAIL and BATT NO CHG lamps are lit, the c.a.g.s. lamps are flashing and No.1 ammeter indicates zero. Cancel flashing lamps.

(19) Run down No.2 engine (Chapter 71, GENERAL). Check that No.2 GENerator FAIL and BUSTIE OPEN lamps are lit, the c.a.g.s lamps are flashing and No.2 ammeter indicates zero. Cancel flashing lamp~~s~~.

(20) Set BATTERY selector switch to OFF and check that all indicating lamps go out.

Emergency contactor control check

Note: Applicable Ni-Cad batteries only: DO NOT disturb thermostat connectors on batteries.

(21) On panel CG select the d.c. voltmeter selector switch to PE.

(22) Disconnect No.3 battery (if fitted).

(23) Check that battery No.1 is connected. If battery No.2 is also connected, disconnect battery No.2, set BATTERY switch to ON and check that d.c. voltmeter indicates No.1 battery voltage.

(24) Set BATTERY switch to EMERG and check that d.c. voltmeter indicates No.1 battery voltage. Set BATTERY switch to OFF.

(25) Reconnect battery No.2 and disconnect battery No.1. Set BATTERY switch to EMERG and check that d.c. voltmeter indicates No.2 battery voltage. Set BATTERY switch to OFF.

(26) Reconnect battery No.1, set BATTERY switch to ON and check that d.c. voltmeter indicates PE busbar (batteries) voltage. Set BATTERY switch to OFF.

(27) Reconnect No.3 battery (if fitted).

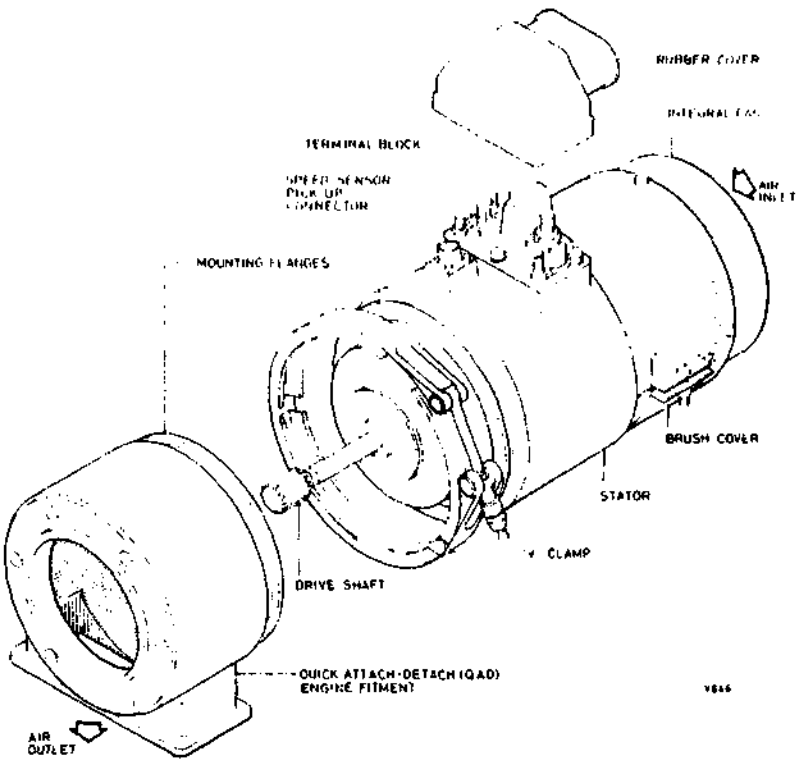
(28) Check that d.c. voltmeter indicates zero volts.

* * *

# STARTER/GENERATOR - DESCRIPTION AND OPERATION

## 1. Description

The Lear Siegler starter/generator provides torque for engine starting from a 24 or 48 volts d.c. supply, and in the generating mode, when driven within its speed range, supplies 28 volts d.c. (regulated), 300 amps, to the aircraft d.c. busbar system.

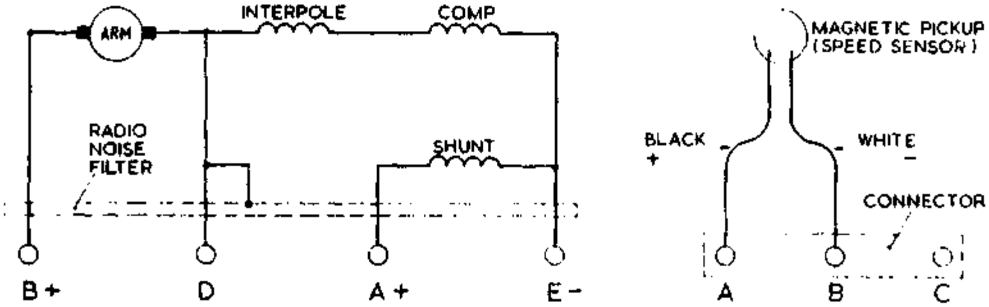


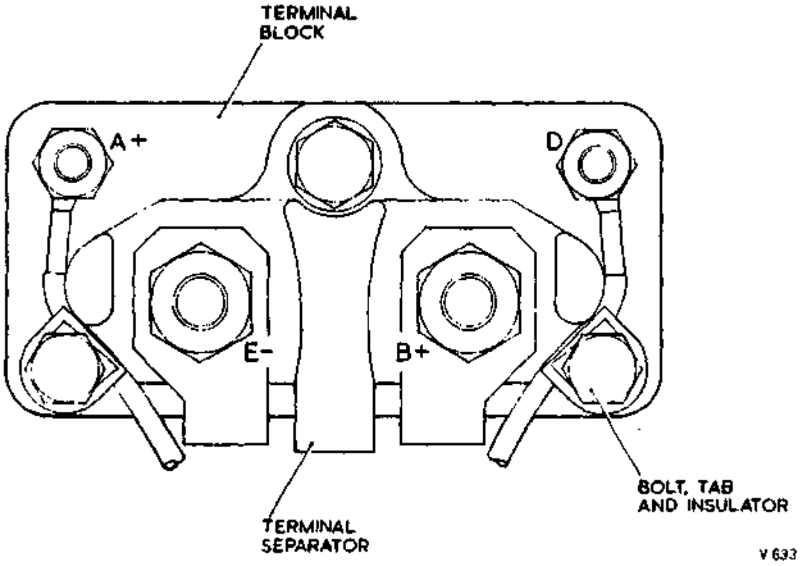
Starter/Generator
Fig.1

The starter/generator is a self-excited, compound-wound machine, and its stator incorporates a shunt field, compensating windings and four interpoles in relation to its four main poles. The stator houses an armature supported by two ball bearings, one at each end of the housing.

Four sets of brushes are fitted in brush holders; brush contact pressure on armature commutator is maintained by coil springs. The brush assembly is secured to an end bell plate.

Also secured at commutator end of the housing, is an integral cooling fan on the drive shaft. The machine is also cooled when airborne, by ram air passing through the inlet and being exhausted at the drive end quick attach/detach (QAD) adaptor.





Identification of starter/generator
terminal block connectors
Fig.2

...Starter/generator - Description and operation continued

Located on the stator is a speed sensor pick-up, which through its connector supplies a signal to the generator control unit (g.c.u.) to effect starter cut-off. Electrical power output to the aircraft system is provided from a terminal block, which includes a potted radio noise filter, and which is enclosed by a rubber cover. Each terminal connection is coded alphabetically.

CAUTION: DO NOT CONDUCT HIGH POTENTIAL TESTS AT TERMINAL BLOCK UNLESS STATOR LEADS TO TERMINAL BLOCK ARE DISCONNECTED, OTHERWISE RADIO NOISE FILTERS IN BLOCK WILL BE DAMAGED.

## 2. Operation

When engine start is initiated, the starter/generator control unit is operative Its generator voltage regulator function is locked-out, and the field-weakening regulator maintains a full field condition on the starter. Initially, starter current is high, and as the engine accelerates the armature current will tend to fall. The g.c.u. senses this fall in current at the interpole windings, the field weakening regulator reduces the field excitation and armature current tends to rise. Starter current is maintained during the starting cycle and provides optimum acceleration for the engine. When the starter reaches a predetermined speed, the starter speed pick-up sensor signal to the g.c.u. terminates the starting cycle. The field-weakening regulator is de-energized, the generator voltage regulator regains control of the field excitation and promotes build-up of generator voltage. When the quality of electrical power-as monitored by the g.c.u. - is correct, the generator will come 'on-line' automatically to supply the aircraft d.c. busbar system.

## 3. Data

| | | |
|---|---|---|
| Plate rating - | starter ... ... | 28V 1000A |
| | generator ... ... | 30V 300A |
| | weight ... ... | 34.9 lbs |
| | speed range ... | 6800 - 12000 rev.min. |
| | cooling ... ... | integral fan and ram air. |

* * *

## STARTER/GENERATOR - MAINTENANCE PRACTICES

### 1. Removal/Installation

Equipment and materials required :-

| | |
|---|---|
| Grease ... ... | Aeroshell 17 or 22, Mobil 28 or 29, or MIL-6-21164 in accordance with Garrett 731 Turbofan Light Maintenance Manual, Chapter 72-00-00. |
| Approved clean engine oil | |
| Torque spanner ... ... | 110 lbf in |

### A. Remove starter/generator (Main engines)

(1) On panel ZK, trip circuit breaker B2, and on panel GA trip circuit breaker B2 (No.1 system) or B1(No.2 system) (see Chapter 24, GENERAL).

(2) Open engine cowl lower access door.

(3) Release clip securing flexible cooling inlet connector to starter/generator.

(4) Pull back starter/generator terminal block rubber cover, disconnect terminal block electrical cables and speed sensor connector.

(5) CAUTION : STARTER/GENERATOR WEIGHS APPROXIMATELY 35 LB.

Support weight of starter/generator, release 'V'-clamp and withdraw starter/generator.

### B. Checks/Tests before installation

(1) Examine condition of the starter/generator heavy duty cables and terminal block rubber cover.

(2) Examine starter/generator drive shaft splines for cleanliness and evidence of excessive wear or damage.

(3) Rotate armature anti-clockwise (drive end) by hand for freedom of movement.

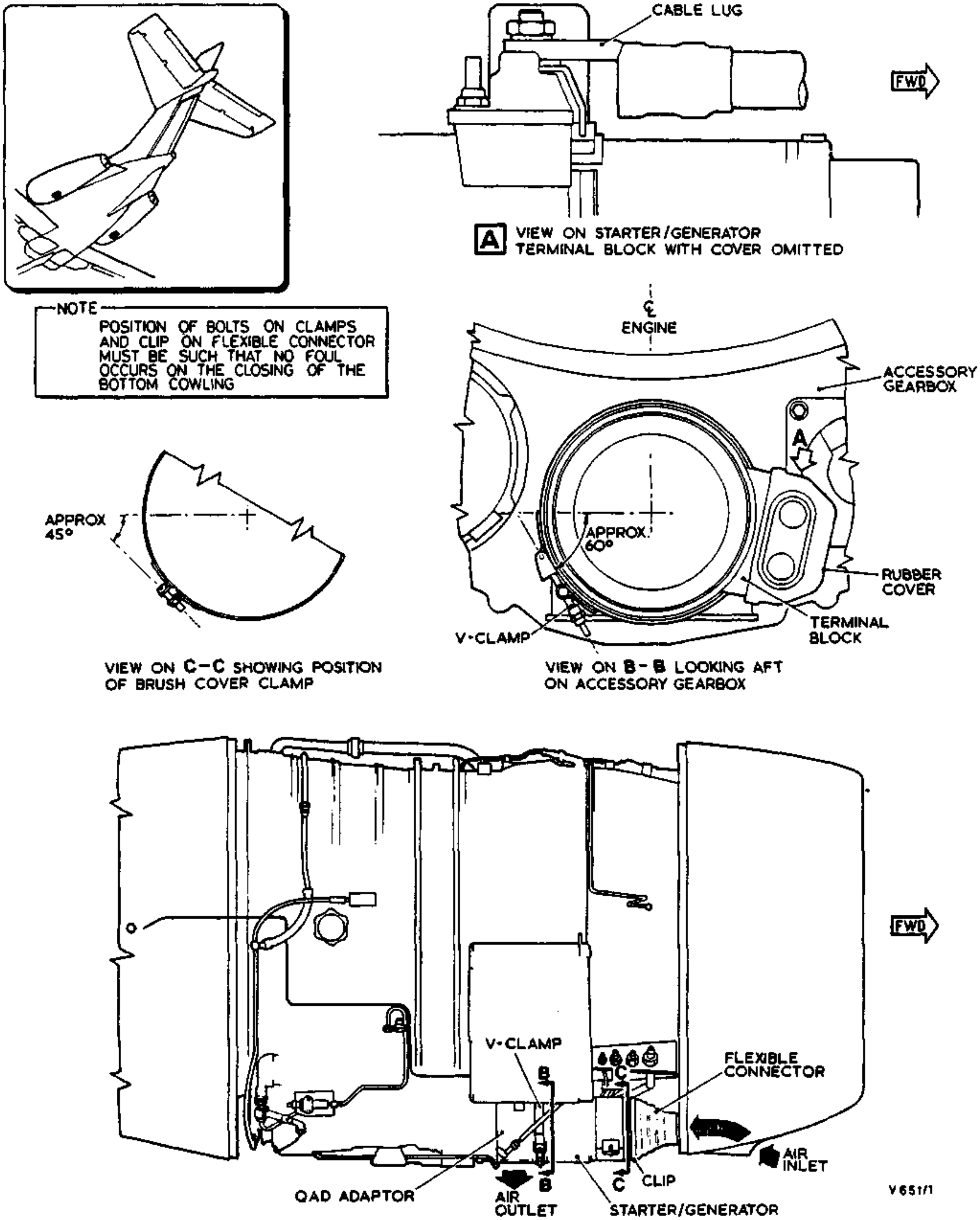
(4) Ensure starter/generator 'V'-clamp and mounting flange contact surfaces are clean and free from damage.

### C. Install starter/generator (Main engines)

(1) Lubricate shaft splines with grease.

(2) Check the quick attach-detach (QAD) adapter for loose mounting against engine. If necessary, lubricate securing nut threads with clean approved engine oil, and torque load nuts to 100-110 lb.ins. Also ensure that QAD adapter mounting flange and clamping surfaces are clean and free from damage.

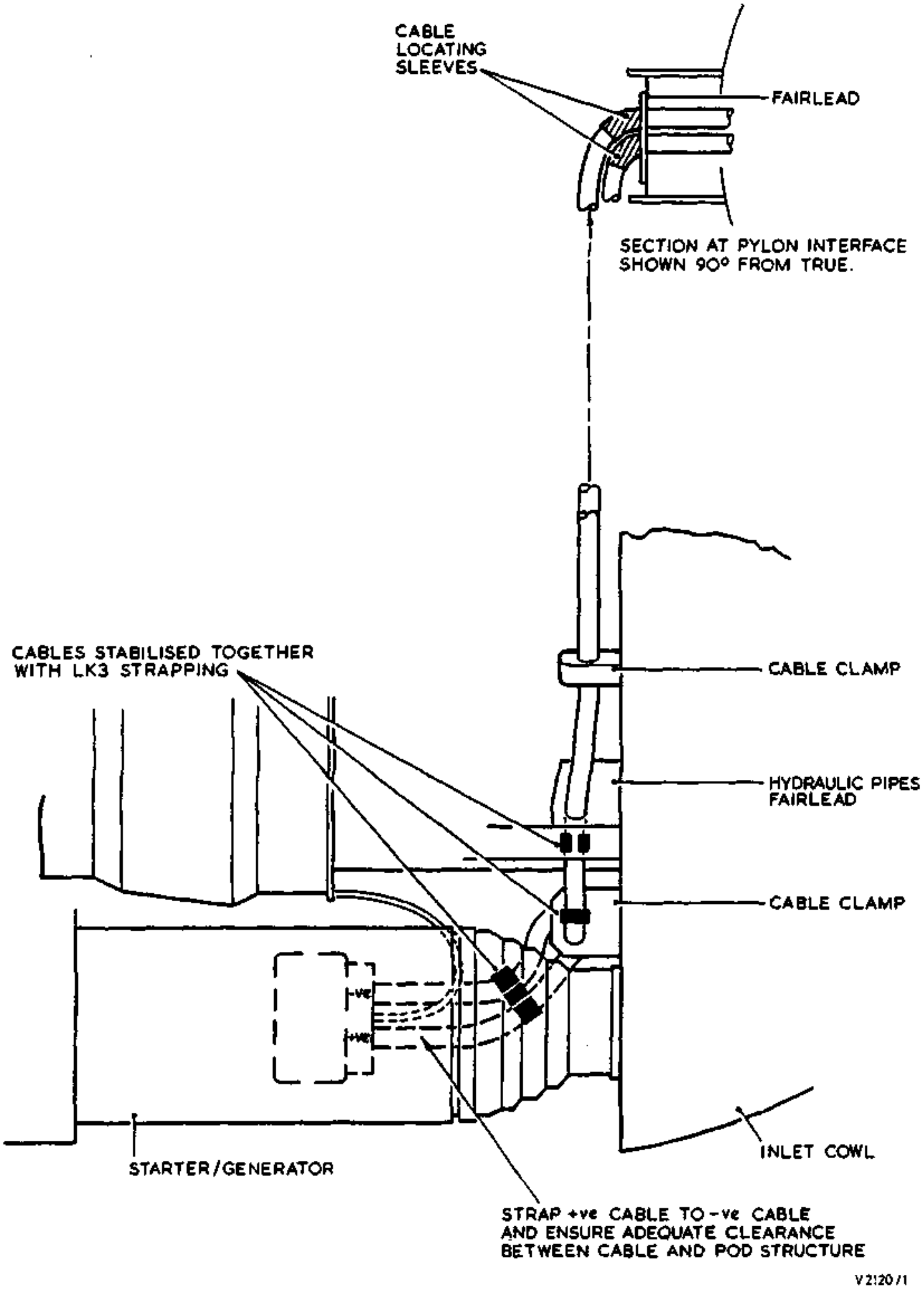
(3) Smear the inside mating faces of starter/generator 'V'-clamp with grease and locate clamp on starter/generator.



NOTE
POSITION OF BOLTS ON CLAMPS AND CLIP ON FLEXIBLE CONNECTOR MUST BE SUCH THAT NO FOUL OCCURS ON THE CLOSING OF THE BOTTOM COWLING

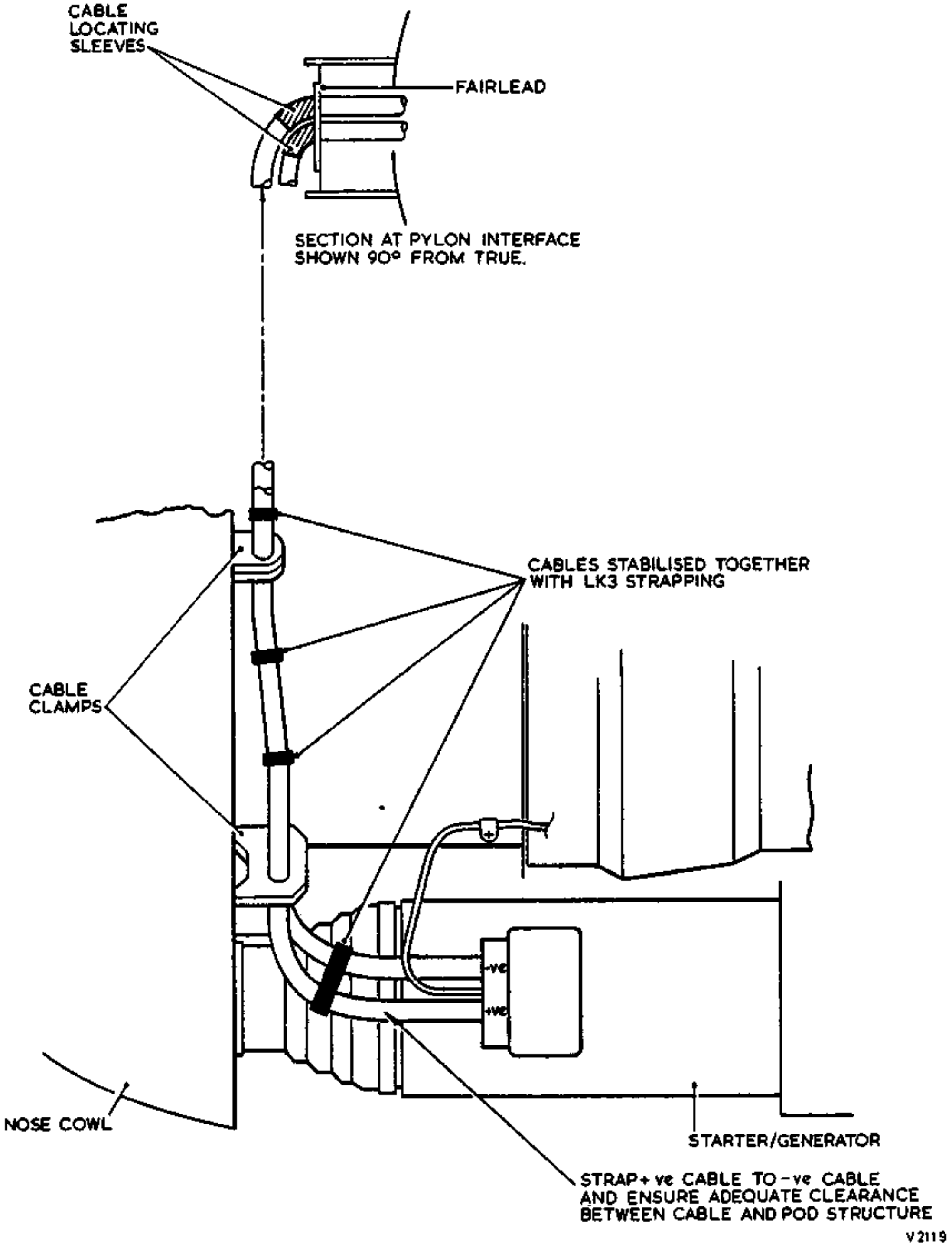
Typical main engine starter/generator installation
Fig.201

..Starter/generator - Maintenance practices contained


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMP
HYDRAULIC PIPES FAIRLEAD
CABLE CLAMP
-ve
+ve
STARTER/GENERATOR
INLET COWL
STRAP +ve CABLE TO -ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2120/1

Location of starter/generator
heavy duty cables (Mod.252779)
Fig.202, Sheet 1 - left engine

..Starter/generator - Maintenance practices continued


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMPS
-ve
+ve
NOSE COWL
STARTER/GENERATOR
STRAP+ve CABLE TO-ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2119

Location of starter/generator
heavy duty cables (Mod.252779)
Fig.202, Sheet 2 - right engine

...Starter/generator - Maintenance practices continued

(4) Supporting weight of starter/generator, position into engine accessory gearbox until fully engaged flush up against the QAD adapter.

CAUTION : KEEP STARTER/GENERATOR FLUSH AGAINST ADAPTER DURING INSTALLATION. DO NOT PERMIT UNIT TO HANG LOOSELY, OR WITHOUT THE 'V'-CLAMP BEING FULLY TIGHTENED OTHERWISE UNDUE BENDING FORCE ON THE DRIVE SHAFT CAN RESULT IN DAMAGE AND IN-FLIGHT FAILURE.

(5) Ensure starter/generator position is as shown on Fig.201 and fit the 'V'-clamp over mating flanges and torque tighten clamp to 70-80 lb.ins. Loosen clamp nut ½ turn and re-torque to 70-80 lb.ins., repeat sequence until clamp bolt ceases to advance.

NOTE : Check starter/generator air outlet for alignment with engine cowl lower door.

(6) Connect cooling inlet flexible connector to starter/generator and secure with clip. See NOTE on Fig.201.

(7) On aircraft Pre Mod.252779, before connecting the starter/generator heavy duty cables, check that cable protrusion from fairlead (Fig.202) at pylon interface is :

Left engine :-
+ve cable = 3 ft 2.0 in. ) from pylon fairlead to centre of cable lug
-ve cable = 3 ft 2.25 in.) eye-end, measure in a straight line.

Right engine :-
+ve cable = 2 ft 6.5 in. ) from pylon fairlead to centre of cable lug
-ve cable = 2 ft 7.0 in. ) eye-end, measured in a straight line.

NOTE : If the cable protrusion is correct, proceed as in operation (9). If protrusion is not correct, embody Mod.252779 (new cables incorporating a shrunk-on locating sleeve to define correct protrusion).

NOTE : Modification No.253267 relocates the earth wire between Pin E on the Starter Generator and Pin F on the Generator Control Unit (GCU). Post-mod 253267, the wire is removed from Pin E and earthed locally adjacent to the GCU. For details of the new wiring refer to Post-mod 253267 Routing Charts or S.B.24-289-3267A,B,C,D,E,F and G.

(8) For aircraft incorporating Mod.252779, before connecting starter/generator heavy duty cables, ensure that the locating sleeves abut the pylon fairlead.

...Starter/generator - Maintenance practices continued

(a) Pre-mod 253267 ONLY: Identify the three wires which terminate at stud E on starter/ generator terminal block, in particular the smallest diameter wire which runs from pin F on the generator control unit. Inspect this wire for breakage or fracture. If it is damaged in anyway it must be changed in one length. Joining or splicing is not acceptable.

(9) Ensure terminal block rubber cover drain hole is free from obstruction and temporarily fitted along starter/generator cables. Connect and secure electrical cables (see Fig.201) to starter/generator terminal block electrical connections. Torque tighten terminal nuts to 100 lb/in., fit rubber cover over terminal block.

(a) Pre-mod 253267 ONLY: Perform a continuity check of the wire between the starter/generator terminal stud 'E', and connector pin 'F' on the generator control unit (wiring diagrams for D.C. Generation Systems No.1 and No.2 refer).

(10) Connect and secure starter/generator speed sensor electrical connector.

(11) Close and secure engine cowl lower access door.

(12) Reset circuit breakers (see para.1.A.(1)).

(13) Functionally test starter/generator (see Chapter 24, DC GENERATION).

D. Remove starter/generator (APU)

(1) On panel DA sub-panel C remove APU CONTROL fuse or trip circuit breaker as appropriate (see Chapter 24, GENERAL).

(2) In the rear equipment bay on the left upper side, release clip securing cooling fan connector inlet to starter/generator. Note position of clip screw.

(3) Pull back starter/generator terminal block rubber cover, disconnect terminal block electrical cables and speed sensor connector.

CAUTION : STARTER/GENERATOR WEIGHS APPROXIMATELY 35 LB.

(4) Support weight of starter/generator, release 'V'-clamp and withdraw starter/generator.

(5) Fit covers to starter/generator electrical connections and aperture, to prevent ingress of foreign matter, also fit cover or tape drive shaft splines for protection in transit.

...Starter/generator - Maintenance practices continued

E. Checks/Tests before installation

(1) Ensure that all starter/generator covers for protection and transportation are removed.

(2) Examine starter/generator drive shaft splines for cleanliness and evidence of excessive wear or damage.

(3) Rotate armature anti-clockwise (drive end) by hand for freedom of movement.

(4) Ensure that starter/generator 'V'-clamp and mounting flange contact surfaces are clean and free from damage.

(5) Examine condition of the starter/generator heavy duty cables and the terminal block rubber cover, for signs of deterioration and damage.

(6) Inspect terminal block for cracks, damaged terminals and signs of shorts between terminals.

F. Install starter/generator (APU)

NOTE: Modification No. 259948 relocates the earth wire between Pin E on the Starter Generator and Pin F on the Generator Control Unit (GCU). Post-mod 259948, the wire is removed from Pin E and earthed locally adjacent to the GCU. For details of the new wiring refer to Post-mod 259948 Routing Charts or S.B.24-284-9948A.

(1) Lubricate drive shaft splines with grease.

(2) Check the quick attach-detach (QAD) adapter for loose mounting against engine. If necessary lubricate threads of securing nuts with clean approved engine oil and torque load nuts to 160-180 lb.ins. Ensure that QAD adapter mounting flange and mating faces are free from damage and foreign matter.

(3) Smear the inside mating faces of starter/generator 'V'-clamp with grease and locate clamp on starter/generator.

CAUTION: KEEP STARTER/GENERATOR FLUSH UP AGAINST QAD ADAPTER DURING INSTALLATION. DO NOT PERMIT UNIT TO HANG LOOSELY OR WITHOUT THE 'V'-CLAMP BEING FULLY TIGHTENED OTHERWISE UNDUE BENDING FORCE ON THE DRIVE SHAFT CAN RESULT IN DAMAGE AND IN-FLIGHT FAILURE.

(4) Supporting weight of starter/generator, position into engine gearbox until fully engaged and flush up against QAD adapter. Locate 'V'-clamp over starter/generator and QAD adapter mating flanges and torque tighten to 70-80 lb.ins.

...Starter/generator - Maintenance practices continued

(5) Connect cooling air inlet connector and secure with clip. Ensure clip is in an accessible position.

(a) Pre-mod 259948 ONLY: Identify the three wires which terminate at stud E on starter/generator terminal block, in particular the smallest diameter wire which runs from pin F on the generator control unit. Inspect this wire for breakage or fracture. If it is damaged in any way it must be changed in one length. Jointing or splicing is not acceptable.

(6) Ensure terminal block rubber cover is temporarily fitted along starter/generator cables. Connect and secure electrical cables to starter/generator terminal block electrical connections.

(a) Pre-mod 259948 ONLY: Perform a continuity check of the wire between the starter/ generator terminal stud 'E' and connector pin 'F' on the generator control unit.

(7) Fit rubber terminal block cover to starter/generator.

(8) Connect and secure starter/generator speed sensor electrical connector.

(9) Close and secure rear equipment bay door.

(10) Reset circuit breaker or refit fuse, as appropriate (see para.1.D.(1)).

(11) Functionally test starter/generator (see Chapter 24, APU GENERATION).

## 2. Inspection/Check

### A. Brush wear check (Fig.203)

(1) Remove starter/generator from engine gearbox (see para.1.A. or 1.D.).

(2) Using a clean cloth moistened with white spirit, or other suitable fluid, thoroughly clean exterior of unit and dry with clean cloth.

(3) Remove brush cover and at each brush position :-

(a) Remove brush lead tag connecting screw.

(b) Raise brush spring, and noting its position in holder, withdraw brush.

...Starter/generator - Maintenance practices continued

CAUTION: IF A BRUSH SHOWS THAT THERE IS LESS USABLE LENGTH AVAILABLE THAN THAT REQUIRED TO REACH THE NEXT SCHEDULED BRUSH CHECK OR REPLACEMENT PERIOD, A NEW BRUSH IS TO BE FITTED. BASE ASSESSMENT ON 1/4 LIFE FOR 100 HOURS RUNNING, UNLESS PREVIOUS BRUSH CHECKS HAVE SHOWN WEAR CHARACTERISTICS IN EXCESS OF THIS RATE.

(4) Examine all brushes for state of seating (Fig.203), evaluate life expectancy and renew if necessary. If existing brushes are satisfactory, refit them in their original positions under spring loading.

(5) Check brushes for freedom of movement in brush holder, and secure brush lead tag to holder with screw.

(6) Ensure that brush leads are positioned so that they are clear of brush holder.

(7) Fit and secure brush cover (Fig.201).

(8) Install starter/generator on engine (see para.1.C. or 1.F.).

## 3.Approved repairs

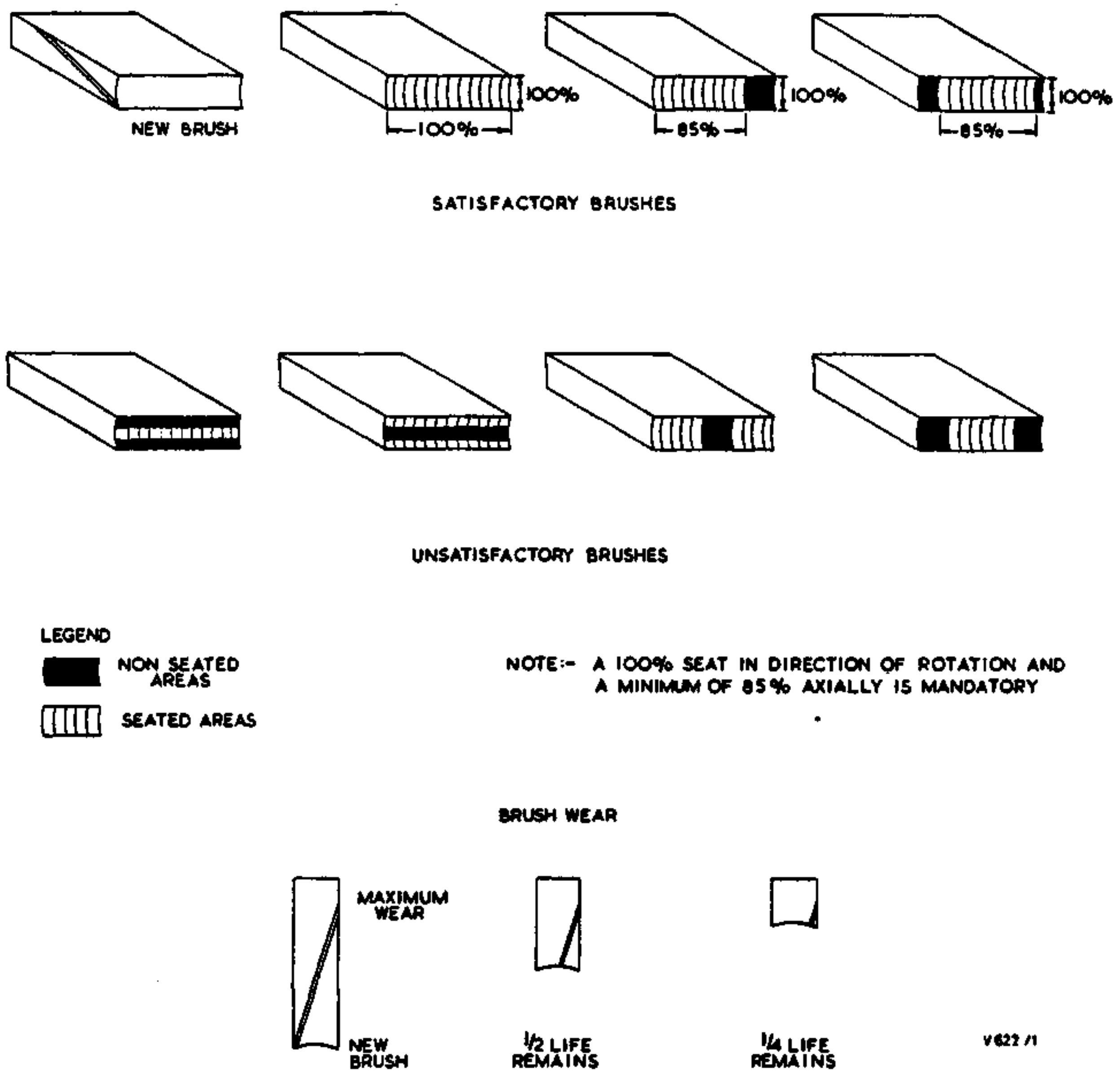
### A.Brush replacement

If visual inspection reveals no other defects necessitating return of unit for overhaul, brush replacement of units functioning normally, but rejected through failure to meet the requirements of the brush wear check detailed in para.2.A., can be effected by operators equipped with suitable workshop facilities.

Replacement brushes, which must be instant filming and of the same manufacturer's part number and/or grade number, should be properly shaped to the commutator surface in accordance with para.3.B. and then bedded by motoring the unit as given in para.3.C.

If commutator is rough, pitted, scored or burned, it must be machined until clean and true but not less than 2.5 in. dia. This operation requires specialist equipment, involves concentricity and balancing checks and should only be effected at Repair Centres authorized by the Starter/Generator manufacturers.

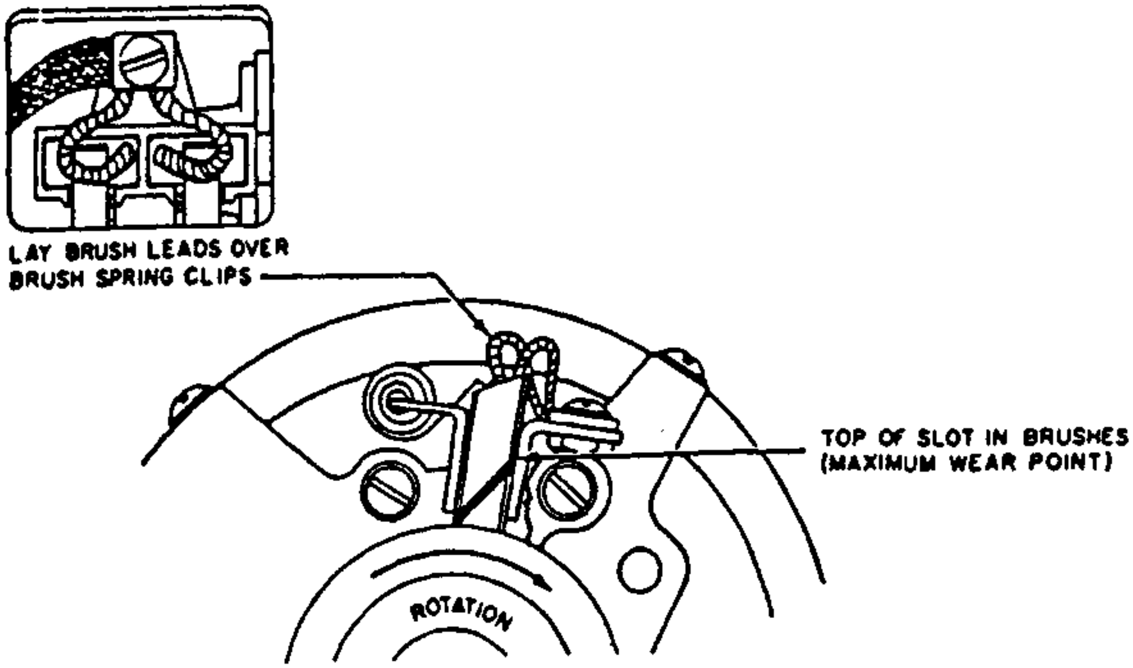
...Starter/generator - Maintenance practices continued



NOTE:- A 100% SEAT IN DIRECTION OF ROTATION AND A MINIMUM OF 85% AXIALLY IS MANDATORY

Brush seating and brush wear
Fig.203

...Starter/generator - Maintenance practices continued


LAY BRUSH LEADS OVER BRUSH SPRING CLIPS
TOP OF SLOT IN BRUSHES (MAXIMUM WEAR POINT)
ROTATION

Correct position of brushes and springs
Fig.204

B.Brush bedding (initial forming)

With replacement brushes correctly installed and connected (para.2.A. and Fig.204) :-

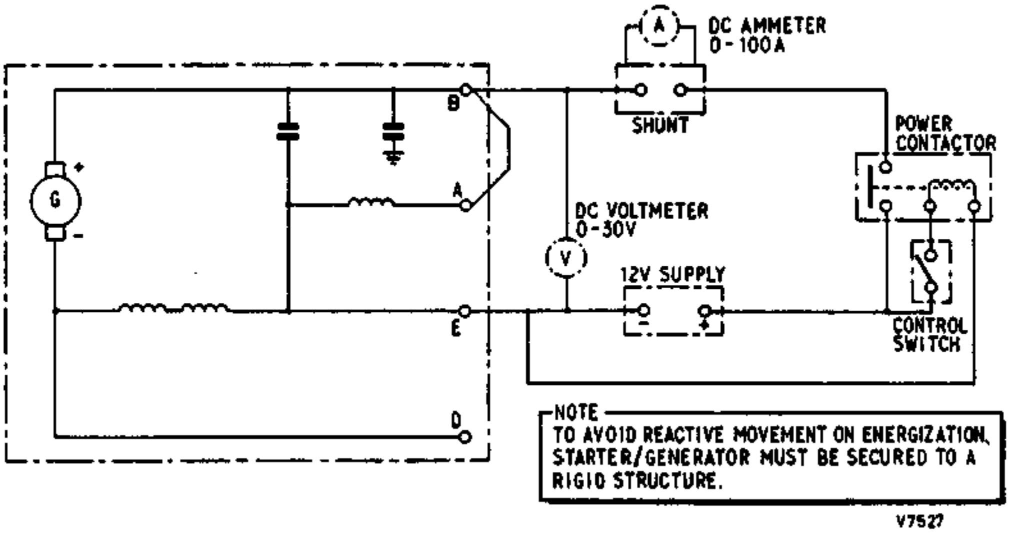
(1) Raise each brush spring with a stiff wire hook, and lift the brush away from the commutator until the brush spring can hold the brush in position by resting against the side of the brush.

(2) Place a strip of very fine (grad 5/0 or inner) sandpaper, slightly wider than the width of the brush, around the commutator with the sand side out. Cut the sandpaper strip to one inch greater than the commutator circumference. Secure one end of the sandpaper strip to lead in the direction of rotation, and the other end will remain loose and overlap taped end.

(3) Lower the brushes in place against the sandpaper, reset brush springs and carefully rotate the armature by hand in the normal direction of rotation until a full seat is obtained on each brush (usually five rotations of armature). Do not sand excessively.

NOTE : Brushes should be seated 100% in the direction of rotation and at least 75% in the axial direction.

...Starter/generator - Maintenance practices continued



NOTE
TO AVOID REACTIVE MOVEMENT ON ENERGIZATION, STARTER/GENERATOR MUST BE SECURED TO A RIGID STRUCTURE.

Circuit for brush run-in
Fig.205

(4) Repeat operation (1) and then remove sandpaper and any carbon dust and grit.

NOTE : If dust removed using dry compressed air, care must be taken to ensure particles blown out of motor and not redistributed without housing.

(5) Lower brushes and reset springs.

C. Brush bedding (finalization)

With replacement brushes fitted and initially formed (para.3.B.) :-

(1) Connect (Fig.205) starter/generator to a robush 12V DC supply (such as a bank of batteries) and, without loading, motor the unit until the brushes are seated 100% in the direction of rotation and in the axial direction. Use blast air cooling during this operation.

NOTE : First check of bedding state should be made after 2 hours running and subsequent checks at 1 hour intervals.

...Starter/generator - Maintenance practices continued

(2) When all brushes are fully bedded, remove carbon dust and check brushes move freely in holders.

NOTE : If dust removed using dry compressed air, care must be taken to ensure particles blown out of motor and not redistributed within housing.

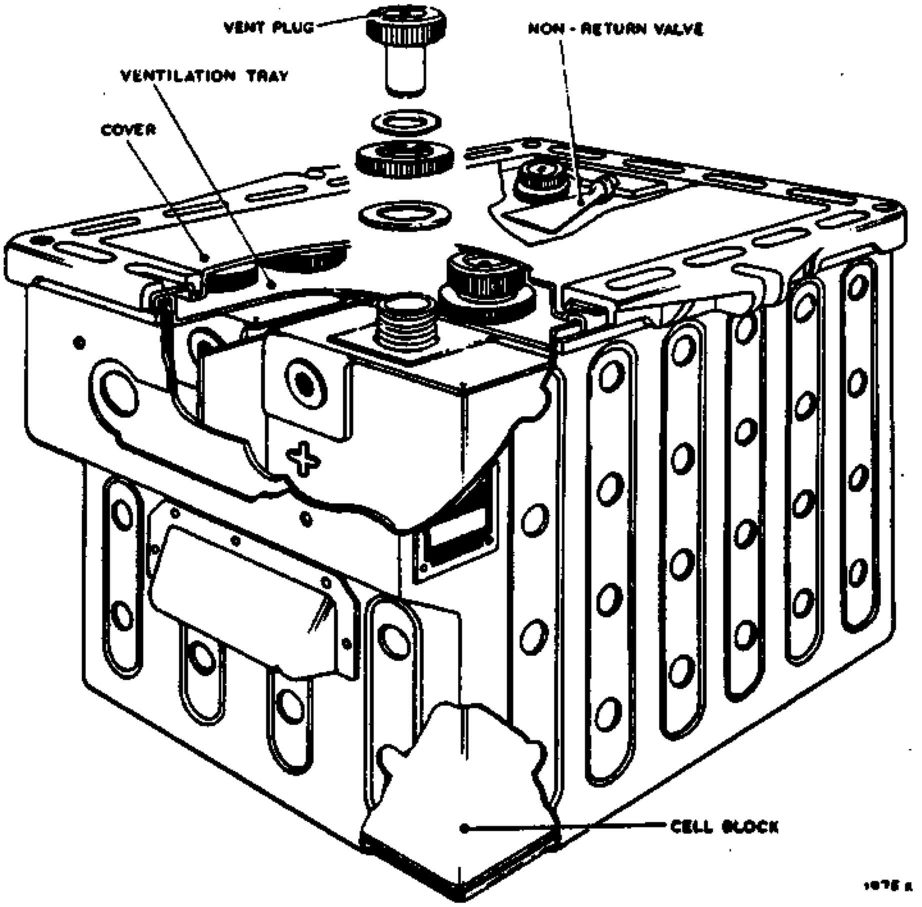
NOTE : Instead of running the starter/generator as a motor, brush run-in may be accomplished by using a generator test stand to drive the starter/generator.

* * *

## BATTERY - DESCRIPTION AND OPERATION

### 1. Description

The Chloride 24-volt 25-Ah lead-acid battery EDQ/F3 is semi-unspillable, and comprises two 12-volt cell blocks moulded in high-impact plastic material contained in an aluminium container. On later batteries (PEDQ/F3), to Mod. 25/7488 standards, the aluminium container is replaced by a glass fibre container.



Battery
Fig.1

Integral ventilation is incorporated, a ventilation chamber being formed by a plastic tray fitted over the cell lids and top edges of the container, and a plastic cover fitted over the tray. If batteries PEDQ/F3 are fitted, glass fibre covers to Mod. 25/7440 standard, must be used. A nozzle on the front of the battery provides a passage between the ventilation chamber and an external extractor tube which exhausts to atmosphere. Ventilation is dependent upon pressurization, and to prevent gaseous flow back into the aircraft during ground charging, a non-return valve is incorporated in the ventilation tray inlet orifice.

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...Battery - Description and operation continued

2. Data

| | | | | | |
|---|---|---|---|---|---|
| Discharge rate (minutes) | 60 | 30 | 20 | 10 | 5 |
| Discharge current (amps) | 25 | 45 | 60 | 105 | 170 |
| Final voltage | 21.6 | 16 | 16 | 16 | 16 |
| Temperature (°C ± 2) | 25 | 25 | 25 | 25 | 25 |
| Electrolyte level | 0.5 in. above separators. | | | | |

* * *

## BATTERY - MAINTENANCE PRACTICES

### 1. Unit servicing

Equipment required :-

Variable resistance capable of carrying 30 amps.
Hydrometer.
Thermometer.
Voltmeter (0-35V, B.S.89 Precision Grade).
Ammeter capable of carrying 30 amps.

### A. Bench charge battery

CAUTION: NEVER ALLOW THE BATTERY TO STAND IN A DISCHARGED CONDITION. DO NOT ALLOW THE ELECTROLYTE TEMPERATURE TO EXCEED 122°F (50°C).

NOTE: To correct specific gravity to 60°F add 2 points to the observed hydrometer reading for every 5°F above 60°F, or subtract if below, e.g. 1.275 at 70°F = 1.279 at 60°F. To correct to 15°C add or subtract 3 points for every 4°C above or below 15°C.

(1) Check the electrolyte levels and top up with distilled water if necessary.

(2) Place thermometer in a 'centre' cell.

(3) Charge at 3½ amps until voltage and specific gravity readings cease to rise for 3 hours.

(4) Check the electrolyte temperature during charge and if it reaches 122°F (50°C) stop the charge until it has fallen by at least 10°F (6°C).

(5) Release any gas retained in the electolyte by gently rocking the battery. Adjust levels to 0.5 in. above separators by removing surplus electrolyte or adding acid of 1.270/1.285 specific gravity.

### B. Capacity test

(1) Fully charge the battery (para.1.A.).

(2) Connect to a suitable variable resistance to discharge the battery at the one hour rate. Note time discharge commences.

(3) Discharge at a constant current equal to the one hour rate until the voltage falls to 21.6 volts. Note time.

(4) Calculate the actual capacity of the battery as a percentage of the rated capacity and if it is 80% or greater record this figure and the date on the battery housing.

NOTE: The actual capacity is the time recorded expressed as a percentage of one hour, e.g. If time taken for voltage to fall to 21.6 volts is 50 minutes, then capacity = $\frac{50}{60} \times 100 = 83\%$.

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...Battery - Maintenance practices continued

(5) If capacity of battery is 80% or more, recharge (para. 1.A.) and return to service.

(6) If capacity of battery is less than 80%, recharge the battery (para.1.A) and give 6 hours extended charging time, then repeat operations (2) to (4).

(7) If battery again fails the capacity test, record the actual capacity and the current date on the battery housing. The battery must then be withdrawn from aircraft use and sent for overhaul.

## 2. Removal/Installation

### A. Remove battery

(1) Ensure BATTERY switch is OFF, and render aircraft electrically safe (see Chapter 24, GENERAL).

(2) Disconnect venting pipes.

(3) Disconnect battery connector.

(4) Release wing bolt securing battery mounting tray assembly to battery shelf.

CAUTION : BATTERY WEIGHS APPROXIMATELY 55 LB. IF ACID SPILLAGE IS SUSPECT TAKE CARE DURING REMOVAL OF BATTERY COMPLETE WITH TRAY ASSEMBLY. MAINTAIN A HORIZONTAL POSITION AND REDUCE THE EFFECT OF FURTHER ACID SPILLAGE.

(5) Ease battery forward until clear of dowels, and remove battery complete with mounting tray assembly from aircraft.

(6) Remove the wing bolts locking nuts securing battery to mounting tray. Lift battery from drip tray in mounting assembly.

(7) Examine battery mounting tray assembly for acid contamination/spillage, if evident see para.3.

### B. Checks/Tests before installation

(1) Ensure battery trays are clean, and drip tray blocks and pads are securely bonded in position.

(2) Remove battery hold-down cover, and check that the battery vent plugs are secure and free from obstruction.

(3) Refit hold-down cover to battery.

(4) Check that battery vent pipes and connections are free from obstruction.

...Battery - Maintenance practices continued

C. Install battery

(1) Locate the battery on drip tray in mounting tray assembly, fit and tighten wing bolts and locking nuts to secure battery to tray assembly.

(2) Position the battery complete with mounting tray assembly in the aircraft, ensuring that the dowels on mounting tray locate in holes in mounting structure. Tighten wing bolt to secure.

(3) Connect and secure battery connector.

(4) Fit and secure battery vent pipes.

(5) Functionally test battery supply circuit (see Chapter 24, DC GENERATION).

3. Cleaning/Painting

Equipment and materials required :-

Acid resistant gloves, apron, goggles and containers.
Swabs or absorbent cloths, a supply of fresh running water and sodium bi-carbonate solution.

A. Acid contamination/spillage

CAUTION : PERSONNEL MUST WEAR PROTECTIVE CLOTHING.

NOTES : Aluminium alloys to which paint scheme and anodic treatment have been removed or damaged, shall be treated with Alocrom 1200 (see Chapter 20, Specification HSA S26.4). When paint scheme 'PS' (Specification HSA S26.3512) is satisfied, apply paint scheme 'X' (Specification HSA S26.3504) in accordance with Chapter 20, STANDARD PRACTICES.

(1) Remove battery or batteries (see para. 2.A.) and fit in an acid resistant container for transport to a servicing bay.

(2) Carefully remove battery drip tray for safe disposal of spilt acid.

(3) Wash drip tray and mounting tray with fresh running water and thoroughly dry. Wash thoroughly with a solution of sodium bi-carbonate to neutralize residual traces of acid. Examine protective finish for damage, and if necessary restore in accordance with Specifications HSA S26.3512 and HSA S26.3504 (see Chapter 20).

(4) Inspect battery shelf and surrounding area for signs of acid contamination/spillage. Soak-up spillage with swabs or absorbent cloths, and then place contaminated materials in acid resistant container with water for safe disposal. Copiously wash the affected areas with fresh clean water and then thoroughly dry. Wash thoroughly with a solution of sodium bi-carbonate to neutralize residual traces of acid.

...*Battery - Maintenance* practices continued

(5) Replace battery securing attachments damaged by acid corrosion.

(6) Examine battery shelf and surrounding areas for damage to protective finish and if necessary restore protective finish in accordance with Specifications HSA S26.3512 and HSA S26.3504 (see Chapter 20).

(7) Fit serviceable battery or batteries (see para.2.B. and 2.C.).

* * *

# BATTERY - DESCRIPTION AND OPERATION
## Hawker Type 9750E0640 (Mod.253235A)

### 1. Description

The Hawker 24-volt 25-Ah lead-acid battery 9750E0640 is a sealed, valve regulated system which allows the battery to be orientated and operated in any attitude or position without spillage of electrolyte.

It comprises two 12-volt sealed monoblocks connected in series, which are tightly enclosed in a polyester bonded fibre glass case, which incorporates the battery main terminal connector. Each monoblock incorporates a resealing safety valve to guard against the effects of abusive use of the battery. There are two external brass terminals on each monoblock, cast into the lead structure of the end cells to minimise the internal resistance. The monoblocks are externally connected by multiple copper strip lamination and to the main battery terminals. The main battery receptacle is an Elcon connector.

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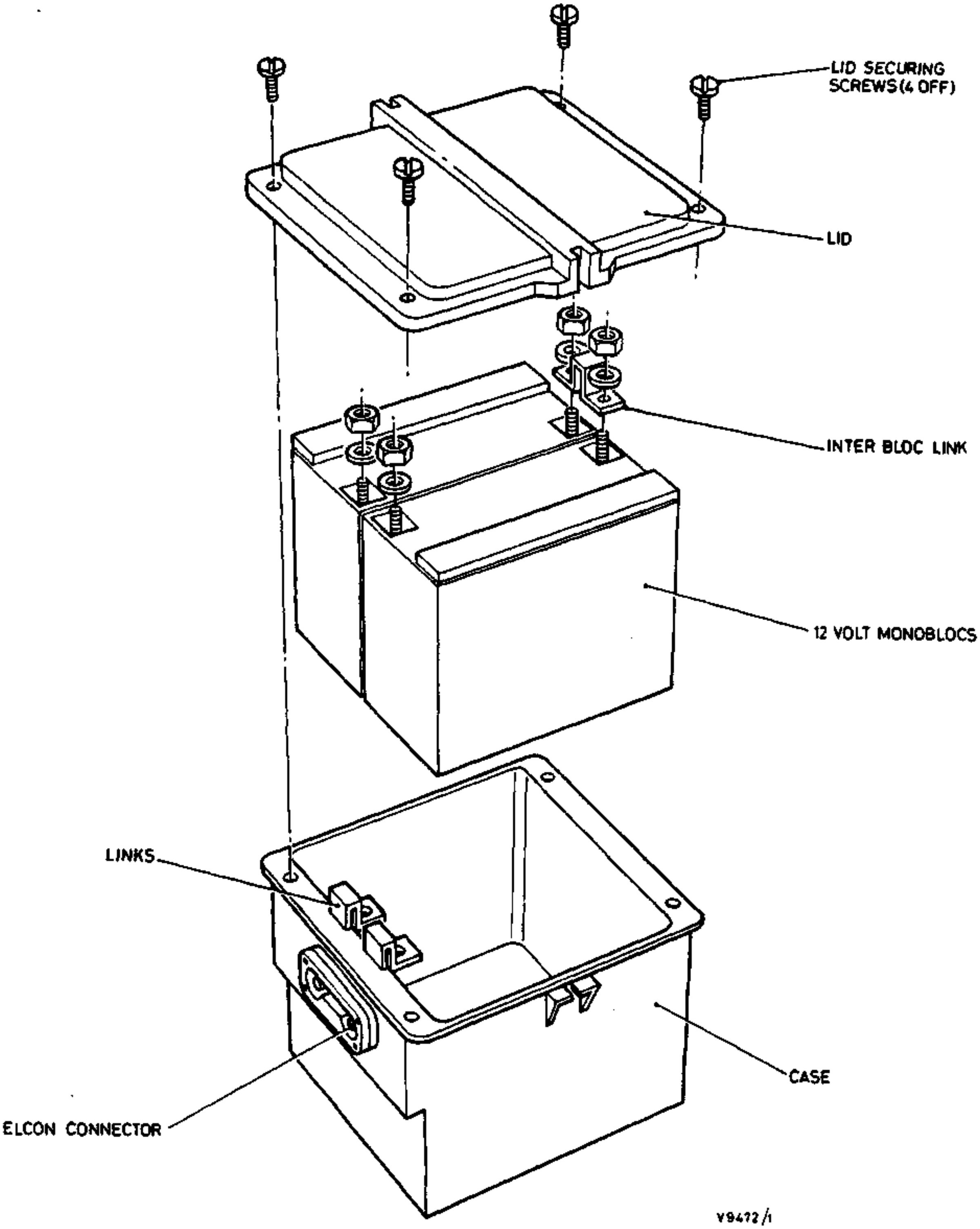
...Battery - Description and operation continued



Battery (Hawker Type 9750E0640)
Fig.1

*  *  *

# BATTERY (HAWKER TYPE 9750E0640) - MAINTENANCE PRACTICES
(Mod.253235A)

CAUTION: THE TWO MONOBLOCKS OF A BATTERY MUST BE CHARGED OR TESTED AS A PAIR, OTHERWISE EARLY FAILURE OF BOTH MONOBLOCKS MAY OCCUR. NEVER LEAVE THE BATTERY IN A DISCHARGED STATE FOR PROLONGED PERIODS. PRIOR TO CHARGING, ENSURE THAT THE BATTERY LID IS SECURELY FITTED.

## 1. Instructions for Recharging and Deep Discharge Recovery

NOTE: A Dedicated lead acid battery room is not required for servicing, a normal electrical workshop maybe used. Also the battery can be serviced in a nickel cadmium battery room without fear of contamination.

### A. Recharging

Equipment required: Constant current charger (capable of applying a voltage in excess of 40 volts).
OR
Constant voltage charger (capable of supplying a minimum of 10 amps).

Constant Current Charger:

(1) Connect battery across a constant current charger and charge battery at 2.0A for 13 hours.

NOTE: Before the battery terminal voltage stabilises at around 31 volts, it may rise as high as 35 volts as the gas recombination process starts. This occurrence will not degrade the battery.

Constant Voltage Charger (30 Volts):

(2) Connect battery across a constant voltage charger and charge battery to the following currents and charge durations:

| CURRENT | CHARGE DURATION |
|---|---|
| 10A | 6 HOURS |
| 20A | 5 HOURS |
| 30A & above | 4 HOURS. |

...Battery - Maintenance practices continued

## B. Deep discharge recovery

Equipment:-

Constant current charger (capable of applying a voltage in excess of 40 volts).
Constant current capacity tester

NOTE : If a battery is heavily discharged, usually due to a low current drain, the open circuit voltage will be very low, i.e. less than 20 volts, and the battery will not accept normal constant current charge from a standard 40 volt charger. Under these circumstances, the battery should be subjected to the following procedure:

(1) Connect the battery across the charger and charge at 1.4 amps for 36 hours.

NOTE: 1. It may be necessary for the charging source to be able to provide up to 80 volts in order to drive the current into the deeply discharged battery. In this event proceed with paragraphs (2) to (7) inclusive.

2. The alternative charging method (paragraph (8) to (14) inclusive) is applicable when a 80V charger is not available. This method allows for a standard 40V charger to be used on individual monoblocks, in turn, to recover deeply discharged batteries.

(2) Attend the battery charging for the first 2-3 hours during which time the current should be carefully monitored. At first the current drawn by the battery may be lower than specified, but should attain this level within 2 hours.

(3) After 4 hours, remove the battery from the charger and leave to stand on open circuit for 2 hours, after which resume charging.

NOTE: The battery may become warm during charging, and if the outer case reaches 50°C, charging should cease until battery temperature drops; charging can then be resumed.

(4) Discharge the battery at 25 amps until either 20 volts end voltage or 48 minutes duration is achieved. If the discharge duration exceeds 48 minutes, the battery has recovered and can be recharged as detailed in para.1.A. and returned to service.

...Battery - Maintenance practices continued

(5) A battery that provides less than 48 minutes duration, but in excess of 20 minutes should provide approx.; 30% of nominal capacity. In this case additional cycling will be required. If the discharge duration is less than 20 minutes, the battery is unlikely to recover and should be rejected.

(6) Perform two charge/discharge cycles at the normal rate (para.1.A.); each cycle should increase the battery capacity. The final discharge should exceed 48 minutes (80% of nominal capacity).

(7) Recharge the battery (para.1.A.).

Alternative Method (see NOTE 2)

(8) Remove the battery cover lid.

(9) Connect the charger across one monoblock only.

NOTE: Do not remove the monoblock interconnecting metal laminations.

(10) Charge the monoblock at 1.4 amps for 36 hours and apply the maximum charger voltage available.

NOTE: It is essential that the current is carefully monitored and must not be allowed to exceed the level specified. As the monoblock accepts the charge the applied voltage will begin to fall.

(11) When the monoblock terminal voltage is at 18 volts during the constant current charge, discontinue charging and repeat the procedure with the other monoblock.

(12) When each monoblock individually accepts the specified charge current at 18 volts, refit the battery cover lid.

(13) Connect the battery across the charger and charge at 1.4 amps for 36 hours.

(14) Continue the recovery process as specified in Para. (2) to (7) inclusive.

## 2.Removal/Installation

### A.Remove battery

(1) Check that BATT switch on flight deck roof panel is OFF and render aircraft electrically safe (Chapter 24, GENERAL).

(2) Disconnect the Elcon connector from the battery. Examine connector for any signs of arcing or deterioration.

...Battery - Maintenance practices continued

(3) Remove locking wire, unscrew wing bolt securing battery tray to battery slideway and pull bolt to upper retained position.

CAUTION: BATTERY WEIGHS APPROXIMATELY 60 LBS.

(4) Pull mounting tray forwards until spigots at rear of tray clear anchorage and remove battery and mounting tray from aircraft.

(5) Slacken lock-nuts on mounting tray wing bolts, remove wing bolts and lift battery from tray.

### B. Checks/Tests before installation

(1) Check that battery is serviceable.

(2) Check that battery trays are clean and dry, and drip tray blocks and pads are securely bonded in position.

(3) Check battery terminal connectors for signs of damage, corrosion, and ingress of dirt/water.

### C. Install battery

(1) Place battery on drip tray in mounting tray and secure by fitting and tightening wing bolts. Lock the bolts by tightening locking nuts onto top surface of mounting tray.

(2) Position battery with tray in aircraft. Check mounting tray spigots are fully engaged in anchorage at rear of battery slideway. Push down and tighten wing bolt to secure battery tray to slideway. Wirelock wing bolt.

(3) Connect the Elcon connector to each battery.
Perform emergency contactor control check (24-30-01, page block 201).
Ensure the connector on each battery is connected and secure.

## 3. Inspection/Check

### A. Capacity check

Equipment required:-

Constant current charger (capable of applying a voltage in excess of 40 volts).
Constant voltage charger (capable of supplying a minimum of 10 amps).
Capacity tester.

...Battery - Maintenance practices continued

(1) Connect the battery across the capacity tester and discharge at a constant current of 25A until an end voltage of 20.0 volts has been achieved or 48 minutes has elapsed which ever is achieved first.

NOTE: Discharge duration should not be allowed to exceed 48 minutes

(2) Record the time taken for the terminal voltage to drop to 20.0 volts if 20.0 volts was achieved prior to an elapsed time of 48 minutes.

(3) Calculate the battery capacity from the following formula:-

$$\text{Battery capacity (\%)} = \frac{\text{Time taken to discharge to 20.0 volts (minutes)}}{60} \times 100$$

NOTE: The above formula is only applicable if the discharge duration to reach 20.0 volts was less than 48 minutes (80% capacity).

(4) If the capacity is less than 80%, recharge the battery (para.1.A.), leave to stand on open circuit for 16 to 24 hours and then repeat operations (1) to (3) inclusive.

NOTE: A four hour minimum stand is sufficient to conduct the test. Also a total of three discharge tests may be carried out to achieve 80% capacity. If after three attempts to achieve 80% capacity the battery fails, then both monoblocks must be replaced.

(5) If the battery capacity is now 80% or greater, recharge the battery (para.1.A.).

(6) After charging allow the battery to stand open circuit for at least two hours.

(7) Remove the four retaining screws from the battery lid and remove lid.

(8) Visually inspect the two 12 volt monoblocks; clean the surfaces of any dirt and possible condensation.

(9) Reinstall the lid and retaining screws and torque tighten to 1.1Nm.

(10) Record the capacity and date checked on the battery case.

* * *

# BATTERY (SAFT TYPE 23491) - DESCRIPTION AND OPERATION

## 1. Description

The SAFT nickel-cadmium battery, consists of twenty individual cells linked in series and assembled in a steel case with a detachable lid. Each cell vent plug incorporates a safety valve set to avoid internal pressure build-up beyond the limit of the cell. Each cell positive terminal stud is identified by a dimple with additional terminal identification, provided by coloured polarity washers.

Inside the battery case, the cells are held tightly packed by wedges and spacers. Vertical movement of cells is further restrained by a rubber gasket attached to the inside of the lid assembly. The lid assembly also includes a non-return valve and an integral hold down bar and strap which accepts hold down securing attachments. The non-return valve, in conjunction with ventilation pipes fitted at the sides of the battery case, provide a passage for cooling air and the extraction of battery gases, the valve preventing gaseous flow-back into the aircraft. The vent pipes can be adjusted through 360 degrees, to suit battery installation in the aircraft.

Battery temperature sensing is provided by two thermostat connecting link assemblies. The thermostats are colour coded, a 'hot' condition (57 deg.C) will operate the black top thermostat and a 'overheat' condition (71 deg.C) will operate the red top thermostat.

Electrical connection to supply battery power to the aircraft system, is provided by an Elcon quick-release connector, and a six-pin connector on the battery case front face connects the temperature sensing thermostats to their warning indicators.

Fig.1 overleaf

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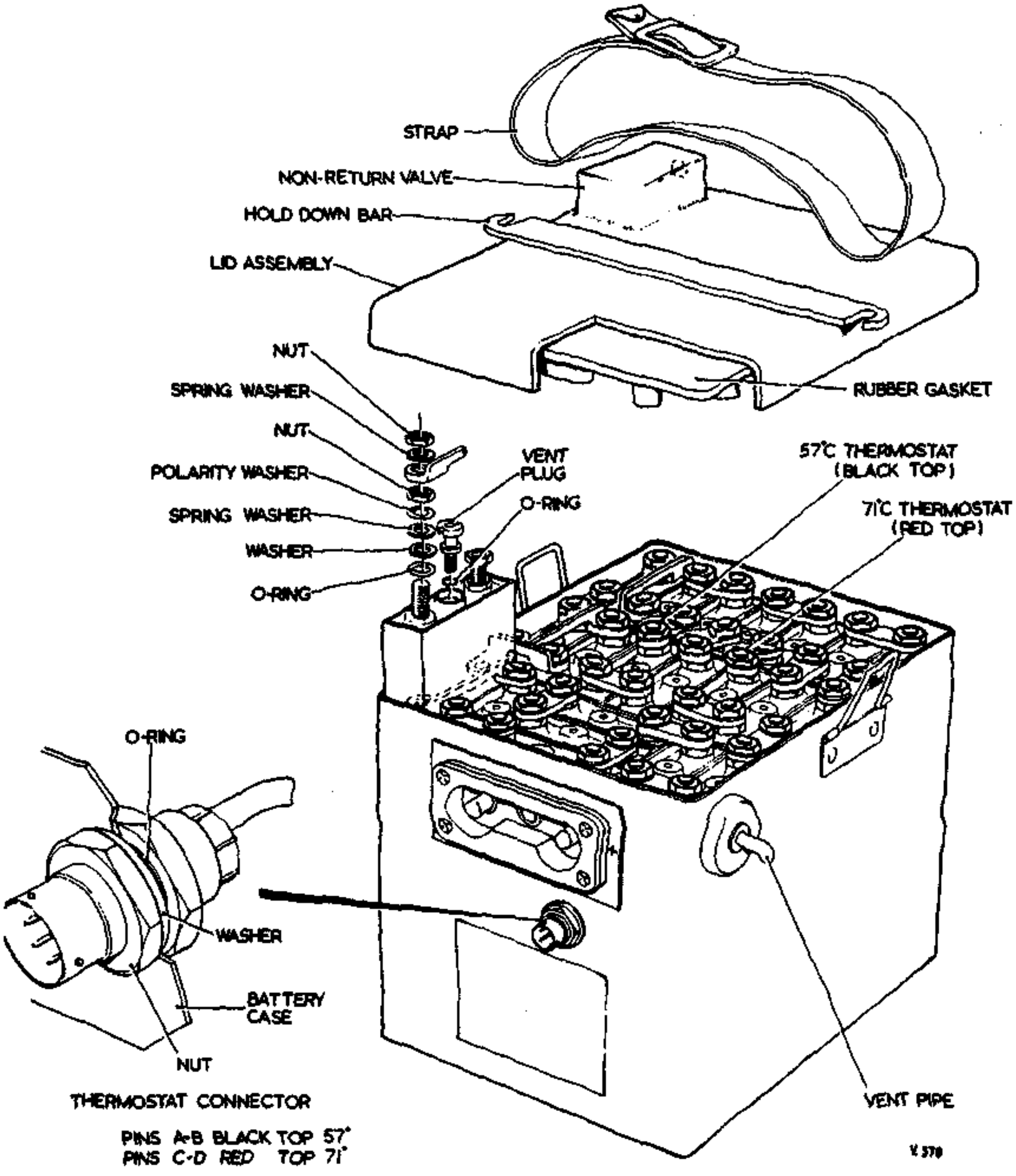
...Battery (SAFT Type 23491) - Description and operation continued



Battery
Fig.1

* * *

## BATTERY (SAFT TYPE 23491) - MAINTENANCE PRACTICES

### 1. Unit servicing - light maintenance

WARNINGS: POTASSIUM HYDROXIDE AND ITS SOLUTION ARE EXTREMELY CAUSTIC. CARE SHOULD BE TAKEN TO AVOID CONTAMINATION. IF SKIN CONTAMINATION OCCURS, THE AFFECTED AREA SHOULD BE IMMEDIATELY FLUSHED WITH LARGE AMOUNTS OF WATER AND NEUTRALIZED WITH 3% SOLUTION OF ACETIC ACID, VINEGAR, LEMON JUICE, OR A 10% SOLUTION OF BORIC ACID.

IF THE EYES ARE CONTAMINATED IMMEDIATELY FLUSH WITH LARGE AMOUNTS OF WATER AND REPORT TO A MEDICAL CENTRE.

DURING BATTERY RECHARGING EXPLOSIVE GASES ARE EMITTED: THEREFORE, GOOD VENTILATION MUST BE MAINTAINED.

BATTERY CONNECTIONS MUST BE TIGHT AND SECURE WITHOUT OVERSTRESSING. LOOSE CONNECTIONS NOT ONLY REDUCE BATTERY TERMINAL VOLTAGE BUT CAN CAUSE ARCING WITH EXPLOSION HAZARD.

BATTERY WEIGHS APPROXIMATELY 55 LBS.
DO NOT LIFT OR HANDLE BATTERY BY VENT TUBES.

WITH BATTERY LID ASSEMBLY REMOVED BATTERY TERMINALS ARE EXPOSED.

ENSURE INSULATED TOOLS ARE USED DURING SERVICING AND METALLIC ITEMS SUCH AS WATCHBANDS AND RINGS ETC. ARE REMOVED AS THESE ITEMS ARE CONDUCTIVE AND COULD CAUSE INJURY TO OPERATOR OR DAMAGE EQUIPMENT WHEN HANDLING BATTERY.

WHEN ADJUSTING ELECTROLYTE LEVELS IT IS RECOMMENDED THAT RUBBER GLOVES, GOGGLES AND A RUBBER APRON BE WORN.

CAUTION: DO NOT ALLOW NICKEL CADMIUM BATTERIES TO COME INTO CONTACT WITH LEAD ACID BATTERIES. KEEP BATTERY CHARGING ROOMS, DEMINERALIZED WATER, TOOLS AND MATERIALS ETC. SEPARATE. USE DEMINERALIZED WATER FREE OF CARBONATE AND ACID OTHERWISE CONTAMINATION WILL DAMAGE NICKEL CADMIUM BATTERIES.

Equipment and materials required :-

Discharger constant current (capacity test set)
Constant current charger
Voltmeter
Distilled water or demineralized water free of carbonate and impurities.
250 volt insulation resistance tester
Syringe (hypodermic type) and 20 m.m. nozzle )
Vent valve key } Part of battery maintenance kit Mk.5
Vent valve 'O' ring seal and band )
Protective grease ... Rocol TFP spray or Ambersil MS4(Aerosol)

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...Battery (SAFT type 23491) - Maintenance practices continued

A. Bench charge battery

(1) Remove battery from aircraft (see para.2).

(2) Remove battery cover assembly, and use vent valve key to loosen but not remove each battery cell vent valve.

(3) Partially discharged battery :-

NOTE : Before charging, check for correct polarity between battery terminals and leads of battery charger.

If a charged battery has remained inactive for more than 2 months, or if its exact state of charge is unknown, the battery must be discharged at a rate of 23 amps to a terminal voltage of 1 volt per cell average (20 volts for a 20 cell battery). It should then be recharged in accordance with operation (4) (a), (b) or (c) below.

(4) Completely discharged battery :-

(a) Charge at 2.3 amps until the battery voltage reaches an average of 1.5 volts per cell (30 volts for a 20 cell battery). Then continue charging at 2.3 amps for 4 additional hours. The total charge time must be at least 14 hours but no more than 15 hours.

(b) Charge at 11.5 amps for at least 2 hours. If after this time the battery voltage has not yet reached an average of 1.55 volts per cell (31 volts for a 20 cell battery), continue to charge at 11.5 amps until voltage rises to this level. However do not charge at this rate for more than 2 hours and 30 minutes. Then charge at 2.3 amps for 4 additional hours.

(c) Charge at 23 amps for at least 1 hour. If after this time the battery voltage has not yet reached an average of 1.57 volts per cell (31.4 volts for a 20 cell battery) continue to charge at 23 amps until the voltage rises to this level. However, do not charge at this rate for more than 1 hour and 15 minutes. Then charge at 2.3 amps for 4 additional hours.

NOTE : Operations (4) (a), (b) or (c) are alternative charging procedures.

(5) Before adjustment of electrolyte level remove vent valve with maintenance kit vent valve key and immerse valve and O ring in de-mineralized water to dissolve salts if required.

(6) Within half an hour of the end of the constant current charge, with charging current still flowing, adjust electrolyte level of each battery cell, and measure each cell terminal voltage. All cells must have a voltage between 1.5 volts and 1.7 volts.

...Battery (SAFT type 23491) - Maintenance practices continued

Electrolyte level adjustment

(7) Using syringe and 20 m.m. nozzle, insert syringe into cell opening until shoulder of nozzle rests on valve seat with the syringe positioned vertically.

(8) Withdraw syringe plunger to remove surplus electrolyte to a level of 20 m.m. below the valve seating.

(9) If no electrolyte is withdrawn, draw pure demineralized water into the syringe up to the 5 cc. mark on the scale and inject it into the cell.

NOTE : A hazard which can cause premature ageing of cells is the ingress of carbon dioxide from the atmosphere. This causes carbonation of the potassium hydroxide electrolyte. If cell valves are removed, they should be refitted without delay, when reason for removal has been satisfied. Likewise the pure demineralized water added to cells for electrolyte adjustments should be carbonate and acid free and not allowed to stand open to atmosphere where it can be contaminated.

(10) Repeat operations (7) and (8). If no electrolyte is withdrawn repeat operation (9) until electrolyte is withdrawn. The level will be correct when surplus electrolyte is withdrawn.

NOTE : If, on average, cells require a quantity of water exceeding 20 cc., a check of the charging system and temperature is recommended, and if necessary a shortening of the period between servicings.

(11) Fit and secure serviceable vent valve assembly taking care not to overtighten and thereby distort seals.

(12) Repeat operations (7) to (11) for all cells.

(13) Dry tops of cells using an absorbent material.

(14) Effect insulation resistance check (see para.2.B.).

(15) Lightly grease battery cell terminal posts and connector links using acid-free grease.

(16) Refit battery cover assembly.

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...Battery (SAFT type 23491) - Maintenance practices continued

## 2. Removal/Installation

Equipment and Materials required .. .. .. see para.1.

### A. Remove battery

(1) Ensure BATTERY switch is OFF, and render aircraft electrically safe (see Chapter 24, GENERAL).

(2) Disconnect venting pipes.

(3) Disconnect battery connectors from battery. Examine ELCON connectors for any signs of arcing or deterioration.

(4) Release wing bolt securing battery mounting tray assembly to battery shelf.

CAUTION: BATTERY WEIGHS APPROXIMATELY 55LBS. DO NOT LIFT OR HANDLE BATTERY BY VENT TUBES.

IF ALKALI SPILLAGE IS SUSPECT TAKE CARE DURING REMOVAL OF BATTERY COMPLETE WITH TRAY ASSEMBLY. MAINTAIN A HORIZONTAL POSITION AND REDUCE THE EFFECT OF FURTHER ALKALI SPILLAGE.

(5) Ease battery forward until clear of dowels, and remove battery complete with mounting tray assembly from aircraft.

(6) Remove wing bolts locking nuts securing battery to mounting tray and withdraw battery from drip tray in mounting assembly.

(7) Examine battery mounting tray assembly for alkali contamination/spillage, if evident see para.3.

...Battery (SAFT type 23491) - Maintenance practices continued

B. Checks/Tests before installation

(1) Ensure battery is serviceable.

(2) Check that battery vent tubes and pipes are not obstructed.

(3) Check insulation of battery by connecting a 250 volt insulation tester between either terminal of the main battery terminals and one of the vent tubes. The insulation reading should not be less than 2 Megohms.

(4) Ensure that battery trays are clean, and drip tray blocks and pads are securely bonded in position.

C. Install battery

CAUTION : DO NOT OVER-TIGHTEN BATTERY SECURING BOLTS, OVERTIGHTENING CAN RESULT IN DISTORTION OF BATTERY LID AND INHIBIT PROPER VENTING.

(1) Locate battery on drip tray in mounting tray assembly, fit and tighten wing bolts and locking nuts to secure battery to tray assembly.

(2) Position battery complete with mounting tray assembly in aircraft, ensuring that mounting tray is fully engaged with slideway aft panel anchorage. Tighten wing bolt to secure battery mounting tray assembly to slideway support structure and wirelock wing bolt.

(3) Connect and secure battery connectors.

(4) Fit and secure battery vent pipes.

(5) Functionally test battery supply circuit.

3. Inspection/Check

A. Capacity check (bench check)

NOTE : Testing should be carried out at an ambient temperature of 20 ± 5 deg.C. This check essentially comprises of collecting the electrolyte levels and checking and rebalancing the cell capacities.

(1) Examine battery carefully for signs of electrolyte leakage, cracks, corrosion, or holes.

(2) Examine connected links and connector carefully for signs of arcing or overheating.

(3) Check the cell to case insulation resistance. The value measured must be a minimum of 10 megohms at 240 volts.

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(4) Check the upper cell nut torque setting. This should be 87 lbf.in. ± 8 lbf.in.

(5) Discharge residual capacity at a constant current of 23 amps down to a voltage of 20 volts at the battery terminals. Note the discharge time between stall of discharge and reaching 20 volts. Also, check individual cell voltages at the beginning and the end of discharge with the current flowing.

(6) Check that discharge time is greater than 48 minutes and individual cell voltages are greater than 1 volt before the end of discharge to 20 volts. Failure to meet these requirements indicates faulty cell(s).

(7) Continue the discharge by connecting across each cell a resistance of approximately 1 ohm 2 watts. These resistances may have crocodile clips attached to their leads which allows them to be easily applied to the cell terminals.

(8) Leave the resistances in place overnight and check that cell voltages at the end of this period are less than 50mV.

(9) Remove resistances and clean battery as required.

(10) Recharge and adjust electrolyte level (see para. 1.A.(4)(a) or (b) and (7) respectively.

## 4.Cleaning/Painting

Equipment and materials required :-

Acid resistant gloves, apron, goggles and containers.
Swabs or absorbent cloths and a supply of fresh running water and boric acid solution.

### A.Alkali contamination/spillage

CAUTION : PERSONNEL MUST WEAR PROTECTIVE CLOTHING.

NOTES : Aluminium alloys from which paint scheme and anodic treatment have been removed or damaged, shall be treated with Alocrom 1200 (see Chapter 20, Specification HSA S26.4). When paint scheme 'PS' (see Chapter 20, Specification HSA S26.3512) is satisfied, apply paint scheme 'X' (Specification HSA S26.3504) in accordance with Chapter 20.

(1) Remove battery or batteries (see para.2.A.) and fit in an alkali resistant container for transport to a servicing bay.

(2) Carefully remove battery drip tray for safe disposal of spilt alkali.

...Battery (SAFT type 23491) - Maintenance practices continued

(3) Wash drip tray and mounting tray with fresh running water and thoroughly dry. Wash thoroughly with a solution of boric acid to neutralize residual traces of alkali. Examine protective finish for damage, and if necessary restore in accordance with Specification HSA S26.3512 and HSA S26.3504 (see Chapter 20).

(4) Inspect battery shelf and surrounding area for signs of alkali contamination/spillage. Soak-up spillage with swabs or absorbent cloths, and then place contaminated materials in alkali resistant container with water for safe disposal. Copiously wash the affected areas with fresh clean water and then thoroughly dry. Wash thoroughly with a solution or boric acid to neutralize residual traces of alkali.

(5) Replace battery securing attachments damaged by alkali corrosion.

(6) Examine battery shelf and surrounding areas for damage to protective finish and if necessary restore protective finish in accordance with Specifications HSA S26.3512 and HSA S26.3504 (see chapter 20).

(7) Fit serviceable battery or batteries (see para. 2.b. and 2.c.).

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## BATTERY THERMOSTAT - MAINTENANCE PRACTICES

NOTE : This procedure is more convenient if coincided with battery removal for periodic maintenance, and should be effected when the battery is in a fully discharged state (each cell fitted with a 1 ohm shunt), otherwise the WARNING preceding para.1.A. operation (2) should be observed.

### 1. Adjustment/Test

### A. Functionally test thermostat(s)

Equipment and materials required :-

Water supply and temperature controlled water heater.
Two containers (approximately 0.5 and 1 litre size)
Thermometer (precision 0.5 deg.C)
Stirring tool
Continuity tester or ohmmeter complete with test leads and Thorn-Bendix socket CPTO 6E-10-6S (SR)
O-ring seal (as required) for thermostats' connector.

(1) Remove battery from aircraft (see BATTERY - MAINTENANCE PRACTICES).

WARNING : WITH BATTERY LID REMOVED BATTERY TERMINALS ARE EXPOSED. ENSURE INSULATED TOOLS ARE USED DURING SERVICING AND METALLIC ITEMS SUCH AS WATCHBANDS AND RINGS ETC. REMOVED AS THESE ITEMS ARE CONDUCTIVE AND COULD CAUSE INJURY TO OPERATOR OR DAMAGE EQUIPMENT WHEN HANDLING BATTERY.

(2) Remove battery lid assembly.

(3) Disconnect thermostat link assemblies and relevant cell connecting links to facilitate removal of thermostats on cable slack.

NOTE : If insufficient thermostat cable slack exists to permit the following test procedure to be effected, it will be necessary to disassemble the battery cell arrangement adjacent to the thermostats' connector to provide access, and to withdraw thermostats' connector after removing the securing nut and washer. Discard O-ring seal.

(4) Immerse thermostat into 0.5 litre container three quarters filled with water. Ensure thermostat is not in contact with container walls or bottom.

NOTE : 57 deg.C (hot thermostat is identified with a black top.
71 deg.C (overheat) thermostat is identified with a red top.

(5) Place thermometer in container, so that bulb is adjacent to thermostat assembly.

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(6) Connect continuity tester or ohmmeter, complete with test leads and sockets, to thermostat connector (plug).

(7) Slowly heat water in container, ensuring that water is kept at a temperature of approximately 50 deg.C (hot thermostat) or 60 deg.C (overheat thermostat) for a duration of 10 minutes.

NOTE : This heat soak duration, is to ensure that all components of thermostat assembly are at the same temperature as the water.

(8) Continue to heat water slowly, stirring occasionally and when continuity tester or ohmmeter indicate that thermostat contacts have closed, record temperature.

Hot thermostat contacts close at 54 to 60 deg.C.
Overheat thermostat contacts close at 68 to 74 deg.C

(9) With thermostat contacts operated, switch off heater and place the 0.5 litre container into the 1 litre container. Pour cold water into the 1 litre container, stirring until water levels are the same in both containers.

(10) When continuity tester or ohmmeter indicates that thermostat contacts open, record temperature. Difference between contacts closing and opening is 4 to 10 deg.C.

(11) If preceding tests are outside tolerance, separate containers and repeat operations (8) to (10).

(12) Disconnect thermostat from test lead socket, remove thermostat from water-filled container and dry very carefully.

(13) Effect an insulation resistance check (see para.B.).

(14) Locate serviceable thermostat link assemblies and all connecting links and secure with spring washers and nuts. Ensure cables are safely routed and torque tighten nuts to 79-95 lb.in.

(15) If applicable fit thermostats' connector in battery case cut-out with new O-ring seal, and secure with washer and nut. Also refit battery cells in accordance with manufacturers instruction manual.

(16) Fit and secure battery lid assembly.

(17) Refit serviceable battery to aircraft (see Chapter 24, BATTERY - (SAFT type 23491).

B. Test thermostat insulation resistance

Equipment required :-

500 volt d.c. insulation resistance tester

(1) Using 500 volt d.c. insulation resistance tester, check resistance between each lead and thermostat metal housing. Resistance measured should not be less than 30 megohms.

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# BUSBAR PROTECTION/VOLTAGE SENSING UNIT - MAINTENANCE PRACTICES

## 1. Adjustment/Test

### A. Functionally test busbar protection/voltage sensing unit U 3626

Equipment required:

Regulated d.c. supply 0-35V, 1 amp, using Voltmeter of known accuracy.

(1) Disconnect cable from terminal 3 of busbar protection unit JG on panel DA, and insulate cable end from adjacent structure. Connect +ve cable of regulated d.c. supply to terminal 3 of protection unit and -ve cable of supply to convenient aircraft earth.

(2) Fit temporary link between terminals 11 and 12 of either generator line contactor on panel GA.

(3) Switch on regulated d.c. supply and adjust output to 28V.

(4) Energize the d.c. busbars (see Chapter 24, GENERAL).

(5) Operate BUS TIE switch to CLOSE and check that the BUS TIE warning lamp goes out.

(6) Very gradually increase regulated d.c. supply output and check that the BUS TIE warning lamp illuminates when the supply voltage is between 29V and 30V.

(7) Readjust regulated supply voltage to 28V.

(8) Repeat operation (5).

(9) Very gradually decrease regulated d.c. supply output and check that the BUS TIE warning lamp illuminates when the supply voltage is between 25V and 24V.

(10) Switch off regulated d.c. supply and de-energize the d.c. busbars.

(11) Disconnect regulated d.c. supply and reconnect aircraft cable to terminal 3 of busbar protection unit. Remove temporary link from between terminals 11 and 12 of generator line contactor, and ensure that affected terminals are fully tightened.

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## APU GENERATION - DESCRIPTION AND OPERATION

(Mod 256859)

### 1. Description

The auxiliary power unit (a.p.u.) generating system can provide d.c. power to the busbar system whilst the aircraft is on the ground. A dual purpose starter-generator is used for both starting the a.p.u. and power generation. When in the generating mode the starter-generator output is connected to PS1 and PE busbars. PS2 busbar can also be energized by selecting the BUSTIE switch on the pilots' roof panel to CLOSE. Although normally started using the aircrafts' batteries, which can be supplemented by the output of an "on-line" main generator, the a.p.u. can be started using external d.c. ground power.

The a.p.u. generator can be operated in parallel with the main generators. Circuit interlocks, described below, are incorporated, however, which are active in certain circumstances to inhibit closure of the a.p.u. generator line contactor (g.l.c.).

| | |
|---|---|
| Generator control relay | - prevents a.p.u. generator being excited onto a possible busbar fault whilst generator control switch is set to CLOSE. |
| Ground power auxiliary relay | - inhibits g.l.c. input supply when ground power is being used. |

The a.p.u. control and generator sensing circuits are energized on the ground via a pressure fan relay and an oleo relay, which are in turn operated through a landing gear controlled microswitch, made when the aircraft is on the ground. In this condition, the oleo relay completes the g.l.c. sensing circuit and also inhibits a field latching relay trip discriminant to permit excitation of the a.p.u. generator. When the weight is off the wheels (aircraft airborne) the microswitch opens to de-energize the relays which automatically de-energize the a.p.u. services and inhibit the generator system.

Under normal operating conditions, the transition from starting mode to generating mode is automatic, being effected in the generator control unit (g.c.u.) when the APU START switch is released, or on receipt of a signal from a tachogenerator in the starter generator. Manual control of the generator function is, however, provided by a GEN CLOSE/TRIP switch which is located on the a.p.u. control panel and which is spring biased against both operating positions.

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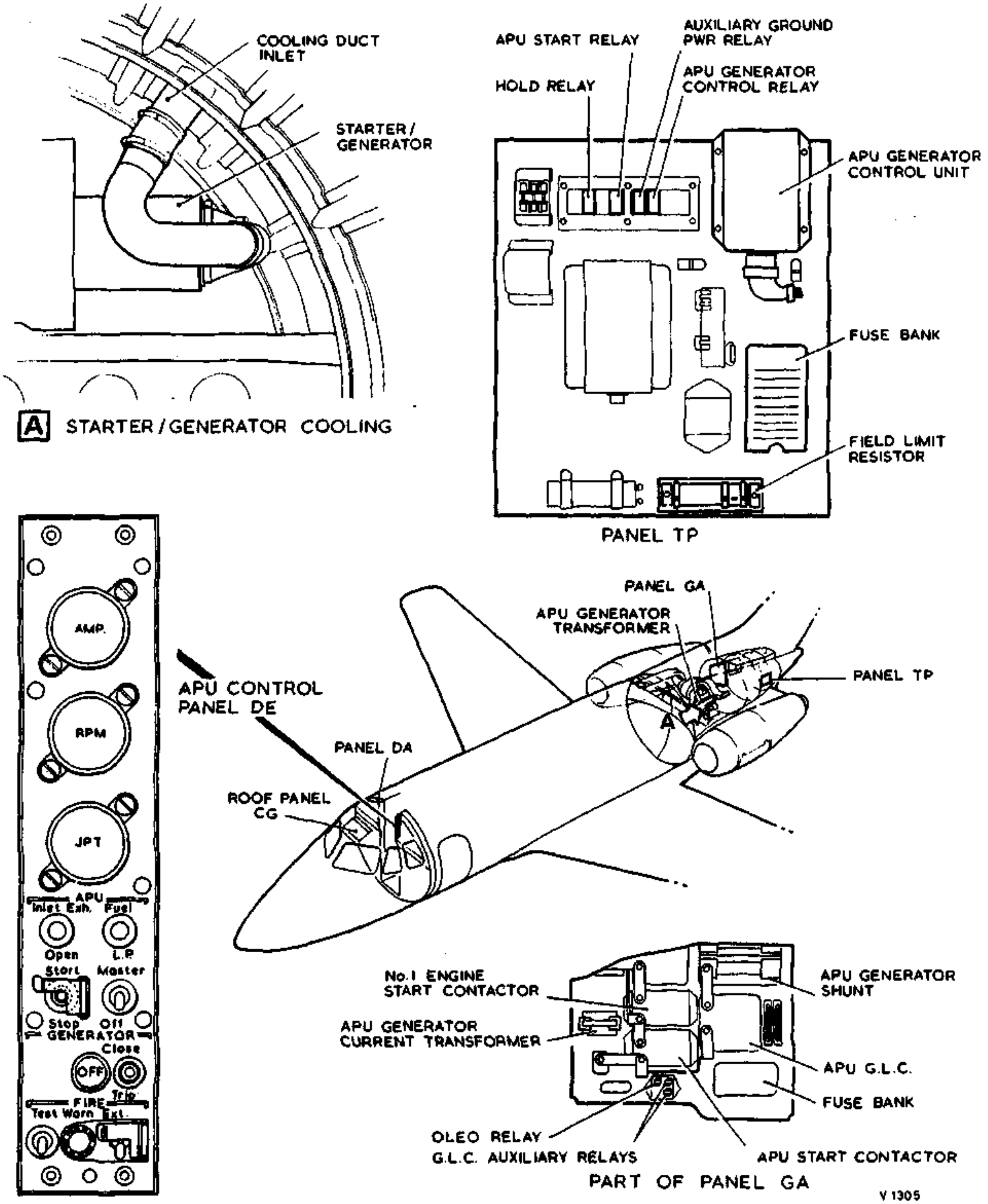

APU generation - location of components
Fig.1

...APU generation - Description and operation continued

When the a.p.u. generator comes "on-line" PS1 and PE busbars are energized and No.1 battery contactor is closed to connect No.1 battery to PS1 busbar. PS2 busbar can be energized by selecting the BUSTIE switch to CLOSE and, consequently, No.2 battery contactor closes to connect No.2 battery to PS2 busbar. (See DC GENERATION).

To prevent the a.p.u. generator being used to assist main engines starting, the supply to the coils of the batteries contactors is routed via normally closed contacts of a cross start inhibit relay. This relay is energized when internal starting of the main engines is initiated to de-energize the batteries contactors, thus disconnecting them from the busbars, and effectively disconnecting the a.p.u. generator from the start busbar. (See DC GENERATION and Chapter 80, STARTING).

Generator system operating status is provided by an ammeter and a magnetic indicator situated on the a.p.u. control panel. When the generated output is connected to the d.c. busbar system, it can also be monitored via the d.c. voltmeter selector switching circuit on roof panel CG.

The a.p.u. starter-generator and control unit are identical to, and interchangeable with, the main generating system components. The starter generator has integral cooling which is supplemented in flight by ram air.

2. Operation

When the BATTery switch is set to ON busbars PE and PE2 are energized. With the aircraft in the normal ground standing position supply is fed via the oleo switch and a.p.u. fire warning relay (reset) to energize the pressure fan relay. When the APU MASTER switch is set to ON supply is fed via the pressure fan relay to a bank of fuses on panel TP to power the APU services (see Chapter 49, APU). Automatically, the a.p.u. cooling air inlet door and exhaust door open and when fully open, operate microswitches to arm the starting circuit. The generator indicator is energized via normally closed contacts of the a.p.u. g.l.c. to show OFF.

The oleo switch also completes a supply to energize the oleo relay, the contacts of which connect No.1 battery to pin E of the a.p.u. g.c.u. to provide a battery reference voltage for generator line voltage comparison. The energized relay also connects the a.p.u. g.c.u. external equalizing circuit to a corresponding pin K on No.2 g.c.u. which in turn is fed to a similar coded pin on No.1 g.c.u. when the bustie auxiliary relay is energized and its contacts closed.

When the APU START/STOP switch is set to START to initiate the start cycle, a supply is fed via the START/STOP switch, the a.p.u. cooling air inlet and exhaust door outlet microswitches and the a.p.u. overspeed switch contacts to energize a hold-on relay which, in turn, applies a start signal to pin W of the a.p.u. g.c.u. to pulse the field latch relay (KFR) to the reset condition. With KFR reset an output from pin Z of the g.c.u. energizes the a.p.u. start relay and a.p.u. start contactor. Within the g.c.u., the start

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signal is applied via a speed switch to the voltage regulator as a "lock out" inhibit during the start mode, thus permitting full field to be applied to the shunt field winding and it also energizes a field weakening circuit which effectively maintains the product of speed and torque constant up to starter cut-off.

At starter cut-off, that is when the start mode is terminated on release of the START/STOP switch, or by the output from the tachogenerator, the speed switch opens to de-energize the field weakening circuit, remove the inhibit on the voltage regulator and terminate the supply to a.p.u. start relay and start contactor. The voltage relay now assumes control over the generator field via the now relaxed contacts of the a.p.u. start contactor. At this juncture the generating function commences and when the quality of the generator output is satisfactory - as assessed by the g.c.u., the g.l.c. sense switch will operate to energize the g.l.c. and connect the output to PS1 busbar. The a.p.u. generator ammeter will then register generator load current and, by selection, the aircraft voltmeter can be used to indicate generator voltage on PS1 busbar. Closure of the g.l.c. is effected by a comparison of generator voltage (pin D) and battery voltage (Pin E) in a sensing circuit, and occurs when generated voltage is within less than 0.3 volt of the battery voltage. The generator supply to the g.l.c. coil is routed via a ground fault transformer, pins A and V of the g.c.u. and then via the contacts of the a.p.u. start contactor and ground power auxiliary relay (see Fig.2).

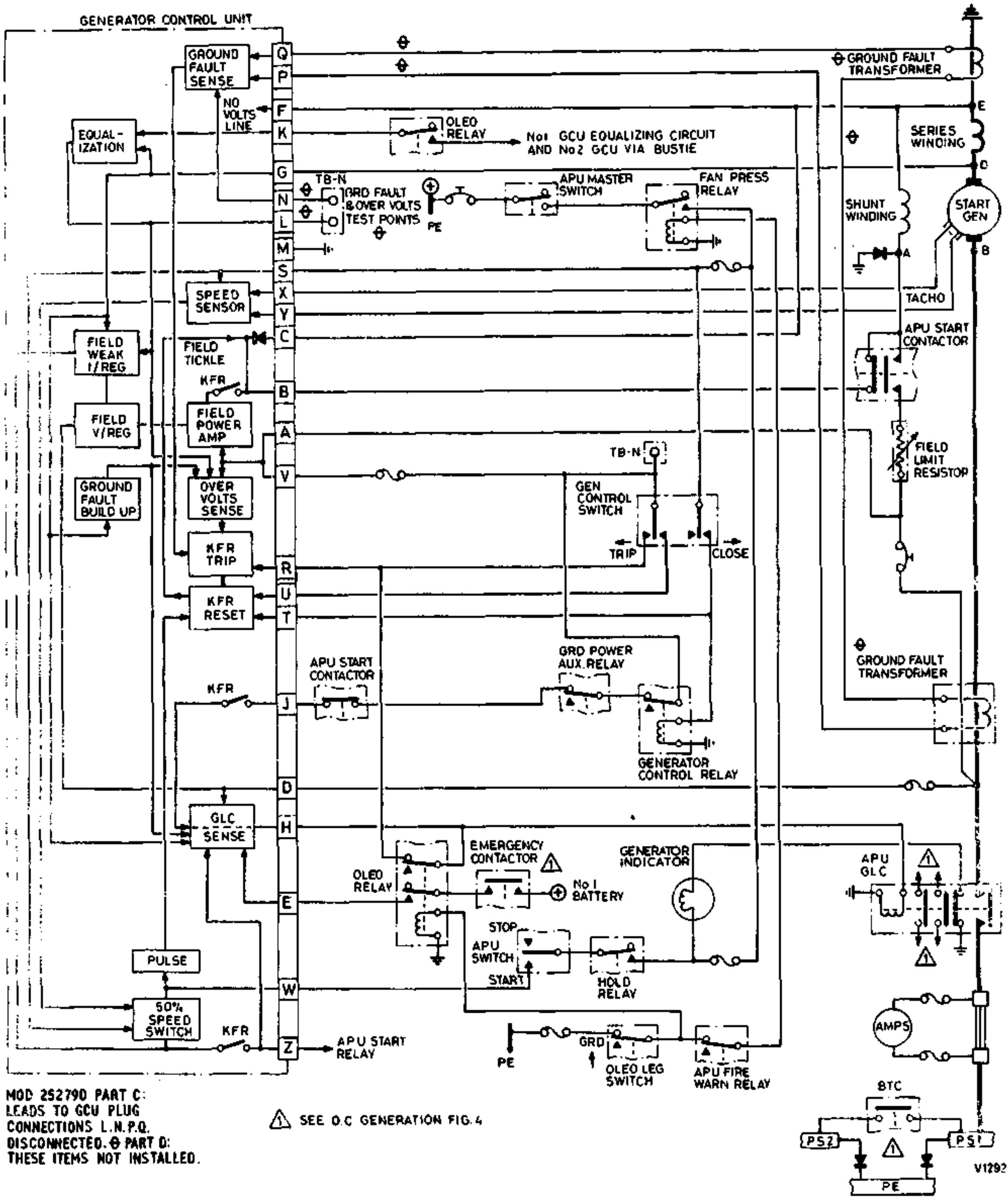
When the g.l.c. closes its auxiliary contacts operate to effect the following:-

(1) De-energize the generator indicator to show ON.

(2) Energize No.1 battery contactor to connect No.1 battery to PS1 busbar.

(3) Arms the bustie circuit for selection of BUSTIE switch to the PS1 and PS2 busbars.

If, for any reason, the generator output and therefore PS1 busbar potential falls to a level sufficient to cause the bustie protection unit to operate, the bustie contactor and bustie auxiliary relay will be de-energized to split PS1 and PS2 busbars and de-energize No.2 battery contactor. Simultaneously, reverse current will flow from PS1 to the generator and the voltage reference at the generator interpole winding will fall to cause the field relay to trip and inhibit the g.l.c. coil circuit. The g.l.c. will be de-energized, its main contacts will open to disconnect the generator output to PS1 busbar and its auxiliary contacts will operate to inhibit No.1 battery contactor coil circuit, thereby isolating No.1 battery from PS1 busbar, and to energize the generator indicator to show OFF.



MOD 252790 PART C:
LEADS TO GCU PLUG CONNECTIONS L.N.P.Q. DISCONNECTED. ⊖ PART D: THESE ITEMS NOT INSTALLED.

⚠ SEE D.C GENERATION FIG.4

APU generation - schematic wiring diagram
Fig.2

ORIGINAL
As Received By
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...APU generation - Description and operation continued

The functioning of the control and protection circuits of the a.p.u. g.c.u. is as described for the main generating system (see DC GENERATION). If the g.c.u. field latch relay has been operated to inhibit the g.l.c., reinstatement of the generator is achieved by setting the a.p.u. GEN switch to CLOSE, which effects the following :-

(1) Connects generator voltage into a field tickle circuit to promote generator build up and resetting of the field relay (KFR).

(2) Connects battery supply (PE) to latch-in anti-cycling relay to prevent tyrrelling of g.l.c. if fault condition persists.

(3) Energizes the generator control relay to inhibit the g.l.c. and allow protection circuits to operate to prevent generator being excited onto a busbar earth fault.

Releasing the switch (spring loaded to central position) will allow the g.l.c. to close providing that the generation parameters are correct and no faults exist. Setting the switch to TRIP applies generator voltage via pin R of the g.c.u. to trip the field relay. The g.l.c. coil circuit is inhibited and the generator de-excited to residual voltage.

* * *

## APU GENERATOR - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Functionally test a.p.u. generation system

(1) Set BATTERY switch to ON and EXT POWER switch to ON. Connect and switch on an external ground supply. Check BUSTIE and BATT NO CHG annunciator is lit and c.a.g.s. lamps are flashing; cancel c.a.g.s.

(2) Start the a.p.u. (see Chapter 49, POWER PLANT, GENERAL) and, if aircraft internal batteries are used, check that GENERATOR indicator shows OFF when a.p.u. MASTER switch is set to 'on' (up).

(3) After starting procedure is completed (a.p.u. START-STOP switch released) if applicable, set EXT POWER switch OFF and check that GENERATOR indicator shows ON.

(4) Set and hold INV 1 switch to START and check that INV 1 FAIL, XE and XS FAIL annunciators are extinguished; release switch.

(5) Set the d.c. selector switch to PS1 and check that d.c. voltmeter registers 28 volts. Also check that a.p.u. ammeter registers load current.

(6) Set BUSTIE switch to CLOSE, check that BUSTIE and BATT NO CHG lamps are extinguished, and d.c. voltmeter registers 28 volts when selector switch is set to PS2.

(7) Set the a.p.u. GEN CLOSE-TRIP switch to TRIP, check a.p.u. ammeter falls to zero, d.c. voltmeter registers generator residual voltage and the GENERATOR indicator shows OFF. Also check that the BUSTIE, BATT NO CHG, XE FAIL and INV 1 FAIL annunciators light.

(8) Set the a.p.u. GEN CLOSE-TRIP switch to CLOSE and check that the GENERATOR indicator shows ON and generator output indicated on ammeter and voltmeter.

(9) STOP a.p.u. (see Chapter 49, POWER PLANT, GENERAL), switch OFF the ground master and battery switches, check ammeter falls to zero and voltmeter registers zero when selector switch is set to PS1 and PS2.

(10) Switch 'off' and disconnect external ground power.

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## DISTRIBUTION - DESCRIPTION AND OPERATION

### 1. General

Power is distributed to the aircraft electrical services from the main distribution panel DA in the forward vestibule, via the primary supply and control panels GA, ZK and ZL in the rear equipment bay. Panel DA houses the majority of aircraft consumer services circuit breakers on five sub-panels, coded A, B, C, D and E. Sub-panels A, B and C are located on the inboard side of panel DA structure, and accommodates circuit breakers for communications, navigational aids and a.p.u. control. Sub-panels D and E are on panel DA forward face, and contain the circuit breakers for general services. The circuit breakers are identified functionally, by a label, and a grid reference on the sub-panels is provided for the operators domestic use. The sub-panels are hinged to the main panel structure, and secured with quick-release fasteners, to enable easy access to the wiring and components within the panel. Also, at the rear of the panel is additional circuit breaker identification, provided by a numerical code label used during production, and referenced on the routing charts contained in the Wiring Diagram wallet. The circuit breakers have their ampere rating marked on the button, and can be manually tripped and reset by operating the 'push-pull' button. The button has a white marker band on its body, to provide visual indication when the circuit breaker is tripped. On panel DA, the circuit breakers that may need to be tripped in the event of an emergency have a white identification surround. Panel DA sub-panels G, H and J contain circuit relays, and sub-panel M the circuit terminal

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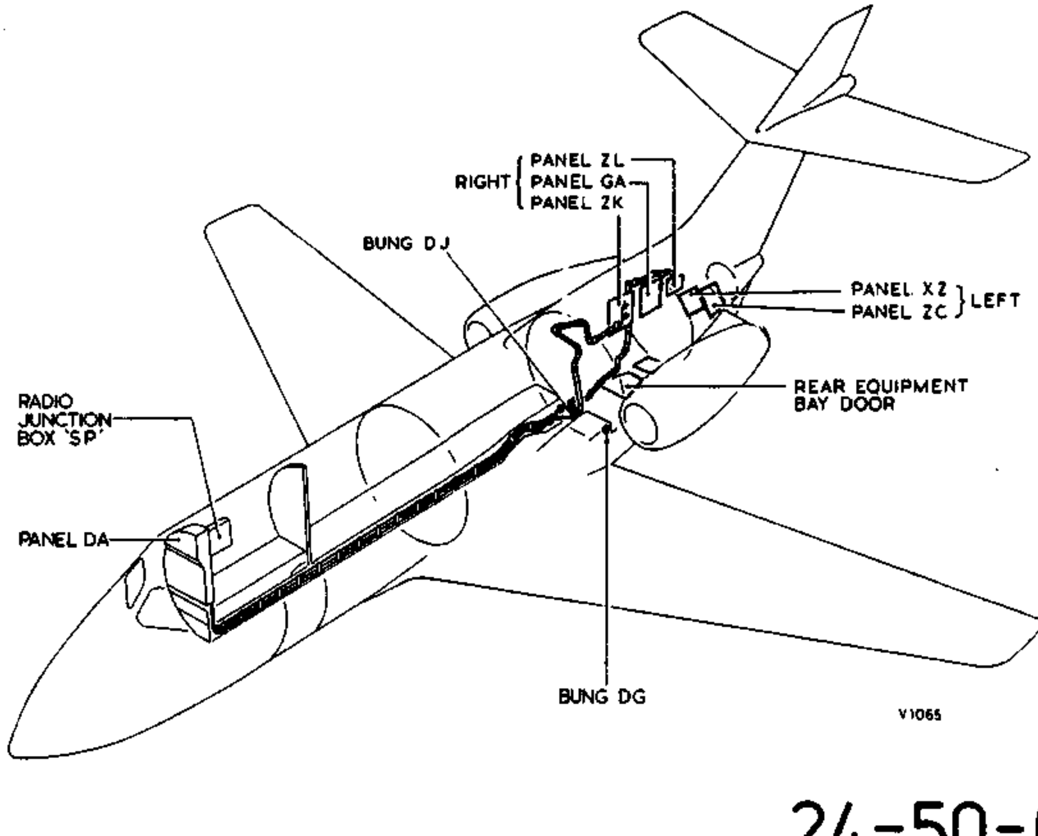
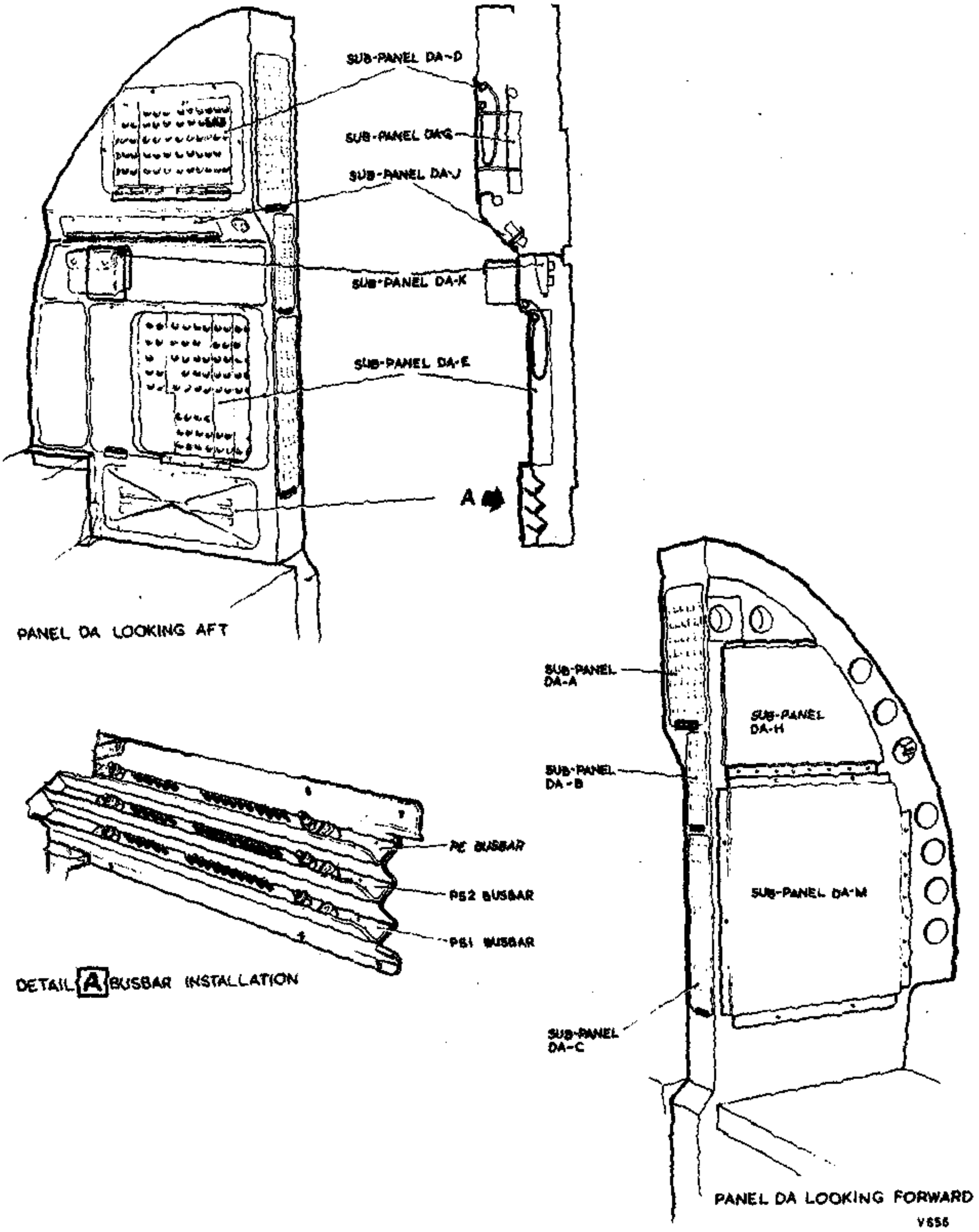


Location of power supply distribution panels
Fig.1

...*Distribution - Description* and operation continued



Main distribution panel and busbar arrangement
Fig.2

...Distribution - Description and operation continued

blocks. In addition, the main panel DA structure houses miscellaneous relays, terminal blocks fuse banks, and other electrical components.

## A. DC distribution

Power supplies from the generators, the aircraft batteries, or an external ground supply are supplied to the aircraft services through a split busbar distribution system. This system comprises, an essential services busbar PE, and a main (non-essential) busbar PS split into two sections, and designated PS1 and PS2. The essential busbar PE is primarily located at panel ZL, and can be energized from the aircraft batteries, generators or ground power supplies. Panel ZL busbar PE supplies are extended via duplicated fuse protected main feeder cables, to distribution busbars PE on panel ZK, and through the pressure dome bung DJ to the main distribution panel DA.

Generated power or external ground power energizes PS1 and PS2 busbars at panel GA, and duplicated fuse-protected main feeder cables connect power to distribution busbars PS1 at panel ZK, and through the pressure dome bung DJ to the main distribution panel DA. Also at panel GA, PS busbars connect their supplies to PE busbar at panel ZL through power diodes.

The d.c. busbar assembly in the main distribution panel DA, consists of busbars PS1, PS2 and PE located on the panel forward face in its lower section. The assembly comprises an angled barrier, made from glass cloth laminations, which supports three copper bars, each having slotted holes and being fitted on 5 and 10 way terminal blocks. At the end of each copper bar, a heavy duty terminal pillar provides connection for the busbar supply feeder cables. Each busbar connection provided by the terminal block studs and end terminal pillars are alphabetically coded and indicated on the wiring diagram routing charts. Busbars PS1, PS2 and PE are also identified with labels.

Busbars PS1 and PS2 are linked together at panel GA when the bustie contactor is energized; the contactor is controlled from the roof panel CG BUSTIE switch when a generator is 'on-line'.

When an external ground power supply is connected to the ground plug on the fuselage right side, selection of the EXT POWER switch on roof panel CG to ON will operate the ground power contactors and connect ground power via panel GA to energize busbars PS1, PS2, PE and PE2. With ground power connected each generator output is isolated from the d.c. busbar system.

If only aircraft batteries are available to provide electrical power, BATTERY switch selection to ON or EMERG will energize the emergency contactors and connect No.1 and No.2 batteries to power busbar PE at panel ZL, via power diodes. Power diodes connected between PS (panel GA) and PE (panel ZL) busbars, prevent PE busbar supplies (batteries) feeding the non-essential services busbars PS, but allows PS busbar supplies to feed the essential busbar PE.

...Distribution - Description and operation continued

On panel ZK, a bank of ring-connected fuses is energized from busbar PE and also from No.3 battery (when fitted) via its energized relay and circuit diodes on panel UH, when the BATTERY switch is selected ON. This fuse bank supply arrangement forms PE2 and provides supplies for engine services such as fuel computer, engine start, r.p.m. and j.p.t. indicators.

As panels ZL, ZK and DA busbar supplies to the majority of aircraft services, are via ring-connected fuse banks and sub-panel circuit breakers. Non-essential services which are duplicated (twin system) or where the load is divisible (lighting etc.) are supplied from busbars PS1 and PS2, so that power failure on either busbar will not result in complete failure of these services. All essential services are supplied from busbar PE.

## B. AC distribution

Constant frequency a.c. outputs from the inverters are fed to the a.c. services via distribution terminal blocks (busbars) XS1, XS2 and XE contained in panel DA, sub-panel M. The general aircraft (non-essential) services are connected to XS1 and XS2, with XE providing all the essential supplies should XS1 and XS2 a.c. electrical supplies fail. The majority of circuit breakers are housed on panel DA, although additional circuit breakers and fuse banks are located on panel ZC and the radio junction box.

## C. Avionic supplies

Panel DA is the primary distribution panel for a.c. and d.c. supplies.

The d.c. supplies are fed directly from panel DA distribution busbars, to various avionic system circuit breakers, located on panel DA sub-panels A, B and C. Some of the basic navigational system supplies are switched through relays in the radio junction box SP. The relays are wired in a fail-safe arrangement and are controlled by two RADIO MASTER switches on the flight compartment pedestal panel BA. When the d.c. busbars are energized and the RADIO MASTER switches selected OFF, the relays are energized, which interrupt the d.c. supplies. When the switches are selected ON, the relays are de-energized and connect the busbar supplies through the relaxed relay contacts to the basic navigational systems.

Single-phase 115 volts 400 Hz a.c. supplies are fed directly from panel DA, sub-panel M, XS1 and XE distribution terminal blocks, to supply the avionic systems via panel DA sub-panels A, B and C.

Depending on operator's requirements, the auto-transformers are located on or adjacent to panel DA, or alternatively in the radio junction box. To special order only, 26 VOLTS FAIL warning lamps for No.1 and No.2 auto-transformers are mounted on the flight compartment roof panel CG. These lamps are connected to PE busbar via the relaxed contacts of relays normally fitted in panel DA. The relay operating coil is energized from the associated auto-transformer 26 volts a.c. output, the relay contacts changeover and the FAIL light goes out. Failure of XE or XS1 supplies causes the associated auto-transformer relay to de-energize, and through the relay relaxed contacts, a supply from PE busbar will light the 26 VOLTS FAIL lamp.

* * *

# CHAPTER

# 25

# EQUIPMENT/ FURNISHINGS

## Chapter 25

## EQUIPMENT/FURNISHINGS

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+ No separate maintenance practices

+ 25-10-04 FLIGHT COMPARTMENT
25-10-12 Crew seats
* 25-10-21 Seat harness - Teleflex Type E74247
* 25-10-32 Control pedestal

* * *

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## FLIGHT COMPARTMENT - DESCRIPTION

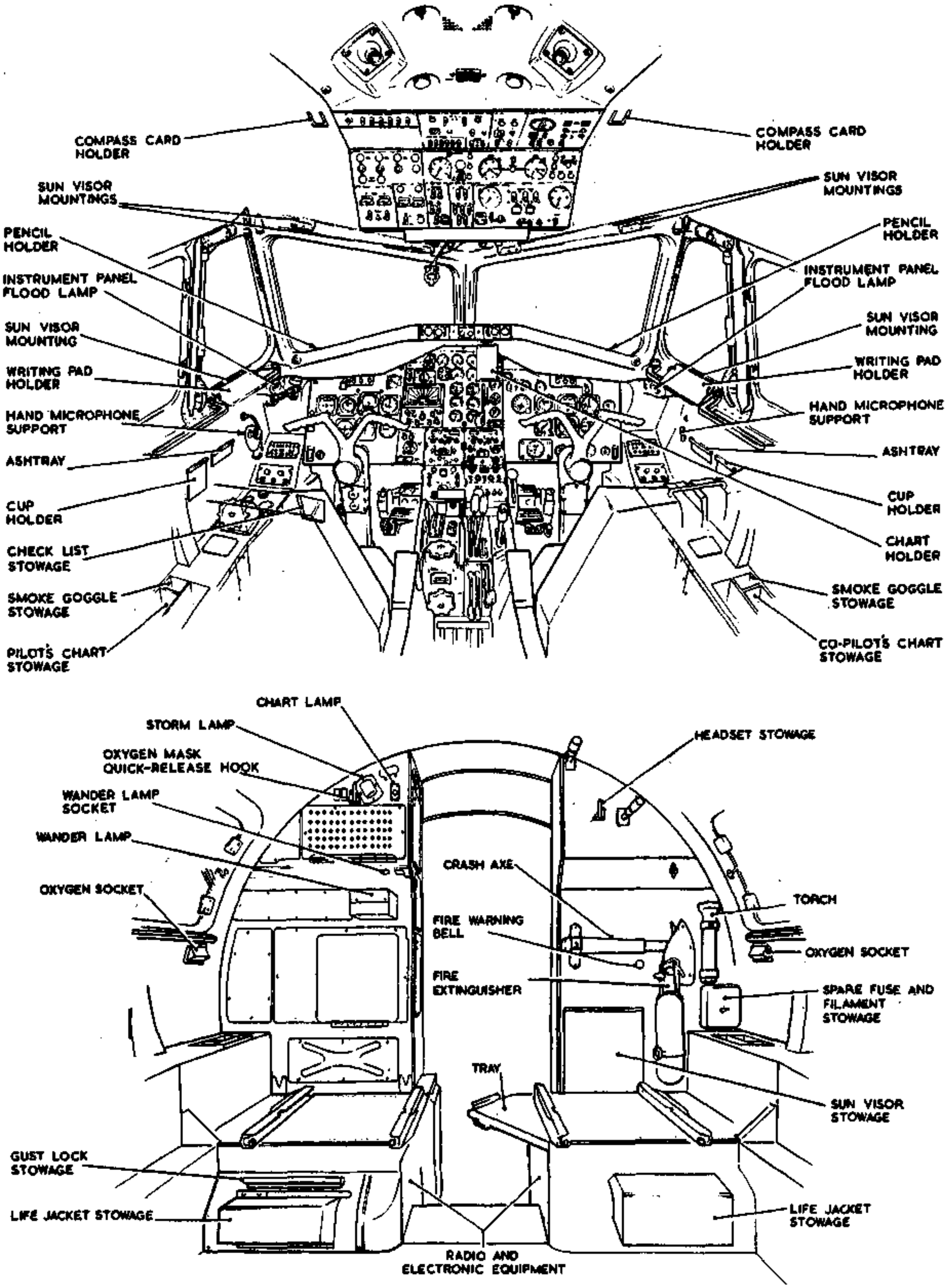
Two Teleflex crew seats are installed in the aircraft and provision is made for an additional seat for a third crew member.

The Captain's and Co-pilot's seats are adjustable for height and fore and aft travel. Each seat is fitted with an inertia reel shoulder harness and lap straps. A lifejacket is stowed in a container mounted under each seat.

Stowages for miscellaneous flight and aircraft equipment are provided in the left and right side consoles and on the flight compartment rear bulkheads. A tray is mounted in the structure under the Captain's seat; in use the tray is swung out where it spans the area between both pilots seats.

Flight compartment interior trim consists of glass fibre panels attached to the roof and sidewall structure. Compartment floor covering consists of carpet and fluted rubber sheet, shaped to conform with the floor area and retained with Velcro tape. Carpet is bonded to the side console panels.

Figure 1 overleaf



Flight compartment layout
Fig. 1

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## CREW SEATS - DESCRIPTION AND OPERATION

### 1. Description (Fig.1)

Each seat assembly comprises a tubular seat frame, a chassis, polyurethane foam and rubber foam filled seat and back cushions, folding arm rests and trim panels. The seat frame is attached to the chassis by pivot arms and is spring-loaded in the upward direction by two tension springs. A lever, with thumb-operated release and a quadrant, provides height adjustment in conjunction with the pivot arms and tension springs. The locking segment of the operating lever locates into one of five slots in the quadrant and retains the seat frame against the tension of the springs.

The chassis rides on slippers and rollers and is locked in any one of six positions by lever-operated plungers which locate into holes in the side of the seat rails. The plunger operating lever is spring-loaded in the forward position; operation of the lever releases the plungers from the seat rails to allow the chassis to slide in either direction along the seat rails.

The back cushion fits over the seat frame and is secured with Velcro tape.

The seat cushion is supported by resilient webbing and is attached to the seat frame with Velcro tape and leather straps fitted with stud fasteners.

Fig.1 overleaf

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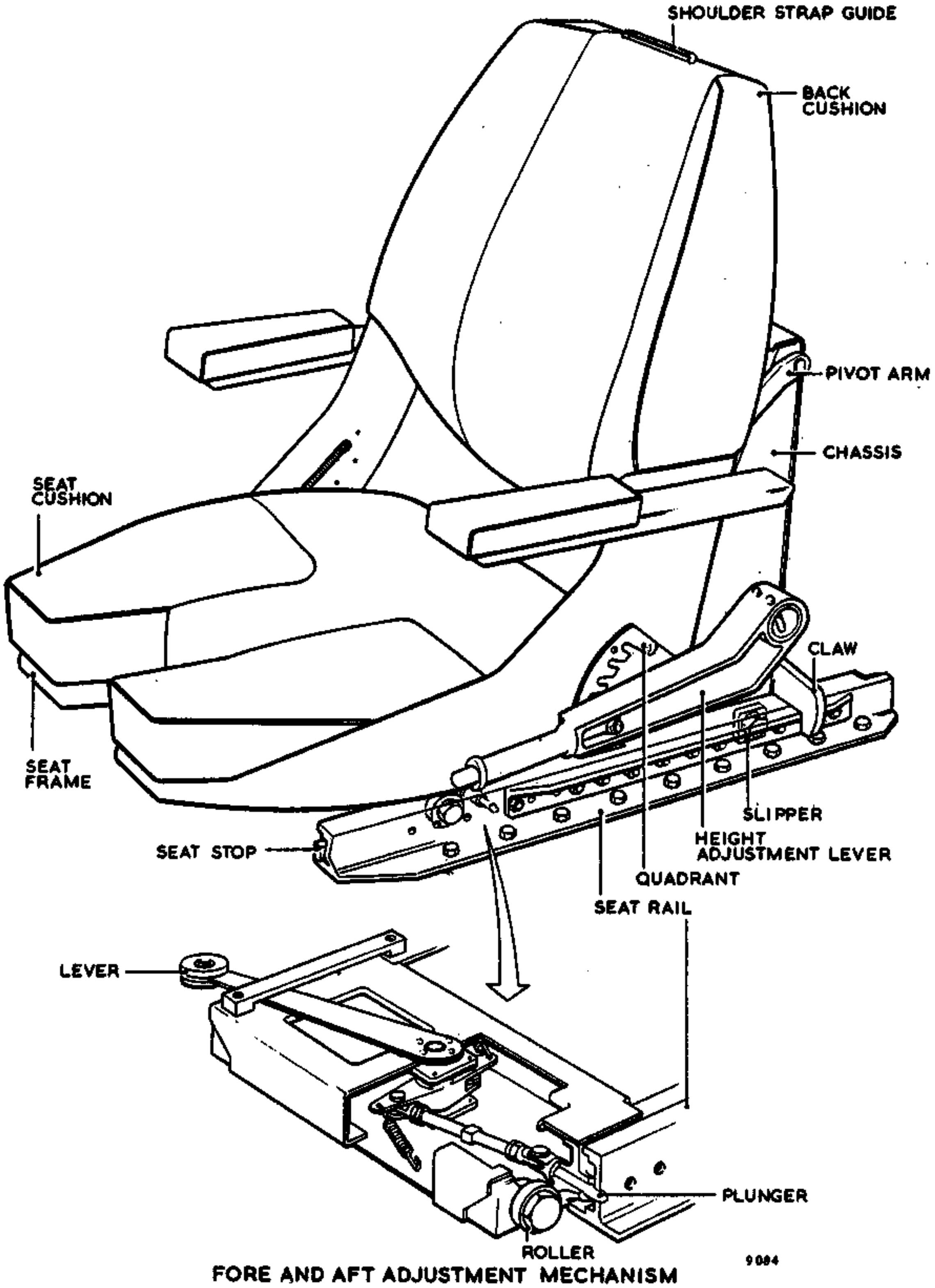

Crew seat
Fig.1

* * *

## CREW SEATS - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove seat assembly

(1) Remove seat stop at forward end of each seat rail.

(2) Operate seat adjustment lever to release plungers from seat rails. Slide the seat assembly forward until chassis rollers are disengaged and the slippers coincide with cut-outs in the seat rails. Withdraw seat assembly from seat rails.

#### B. Install seat assembly

(1) Ensure that seat rails are clean.

(2) Locate chassis slippers into seat rail cut-outs, operate seat adjustment lever and slide seat assembly onto rails to engage rollers.

(3) Release seat adjustment lever when plungers are aligned with the required position holes in the seat rails.

(4) Check seat is locked.

(5) Fit a seat stop, with the radius toward the roller, at the forward end of each seat rail.

* * *

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## SEAT HARNESS - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove complete harness assembly

(1) Operate the quick-release buckle and separate the straps.

(2) Remove the lap belts from the seat frame.

(3) Remove the operator unit from the side of the seat, taking care not to bend the cable assembly.

(4) Withdraw the shoulder straps through the seat strap guide and remove the reel from the back of the seat complete with straps and operator unit.

NOTE : For details of the procedure necessary to remove the harness from the operator unit, refer to the Teleflex harness (E.74247) overhaul manual OAH-1.

#### B. Install complete harness assembly

(1) Secure the lap belts to the seat frame.

(2) Secure the operator unit to the side of the seat and tighten the bolts. Take care not to bend the cable assembly.

(3) Secure harness reel to back of seat and thread shoulder straps through seat strap guide.

(4) Functionally test the harness assembly.

### 2. Checks/Tests after installation

#### A. Functional test of the harness assembly

(1) Operate each adjustment buckle and check that the webbing runs freely and locks securely.

(2) Check that the shoulder straps reel in and out freely and lock when jerked.

(3) Check that the release buckle functions correctly.

(4) Move lever on operator unit to rear position. Check that the reel is locked and that shoulder straps will not reel out.

(5) Move lever to forward position. Check that reel and shoulder straps operate normally.

* * *

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## CONTROL PEDESTAL - MAINTENANCE PRACTICES

(Mod. 251136)

1. Removal/Installation (Fig. 201)

A. Remove control pedestal

Preliminary procedure

(1) Chock the main and nose gear wheels and fit all lock pins (see Chapter 10, or alternatively, jack the aircraft (see Chapter 7).

(2) Release hydraulic pressure (see Chapter 29, MAIN SYSTEM)

(3) Disconnect all aircraft external and internal electrical power supplies (see Chapter 24, GENERAL).

(4) Remove the crew seats ( see Chapter 25, CREW SEATS).

(5) Remove flight compartment floor covering.

(6) Detach the control column socks (gaiter) from the floor panels and remove the metal rings at the rudder pedal adjuster units.

(7) Remove flight compartment floor panels.

(8) Remove the radio guard panel at the side of the left-hand pilot's seat.

(9) Remove the flight compartment step.

(10) Remove the two forward access panels in the vestibule floor.

(11) Remove the necessary radio and flight system controllers to enable access to the screws which secure the pedestal to the controllers panel (see Chapter 23 and 34 for removal of controllers).

(12) Remove the pedestal left- and right-hand side panels.

NOTE : To facilitate removal of left side panel, after releasing fasteners rotate panel towards rear of aircraft through 90° before attempting to disengage from pedestal.

(13) Remove the control lever knobs at the pedestal lower front panel and remove the panel.

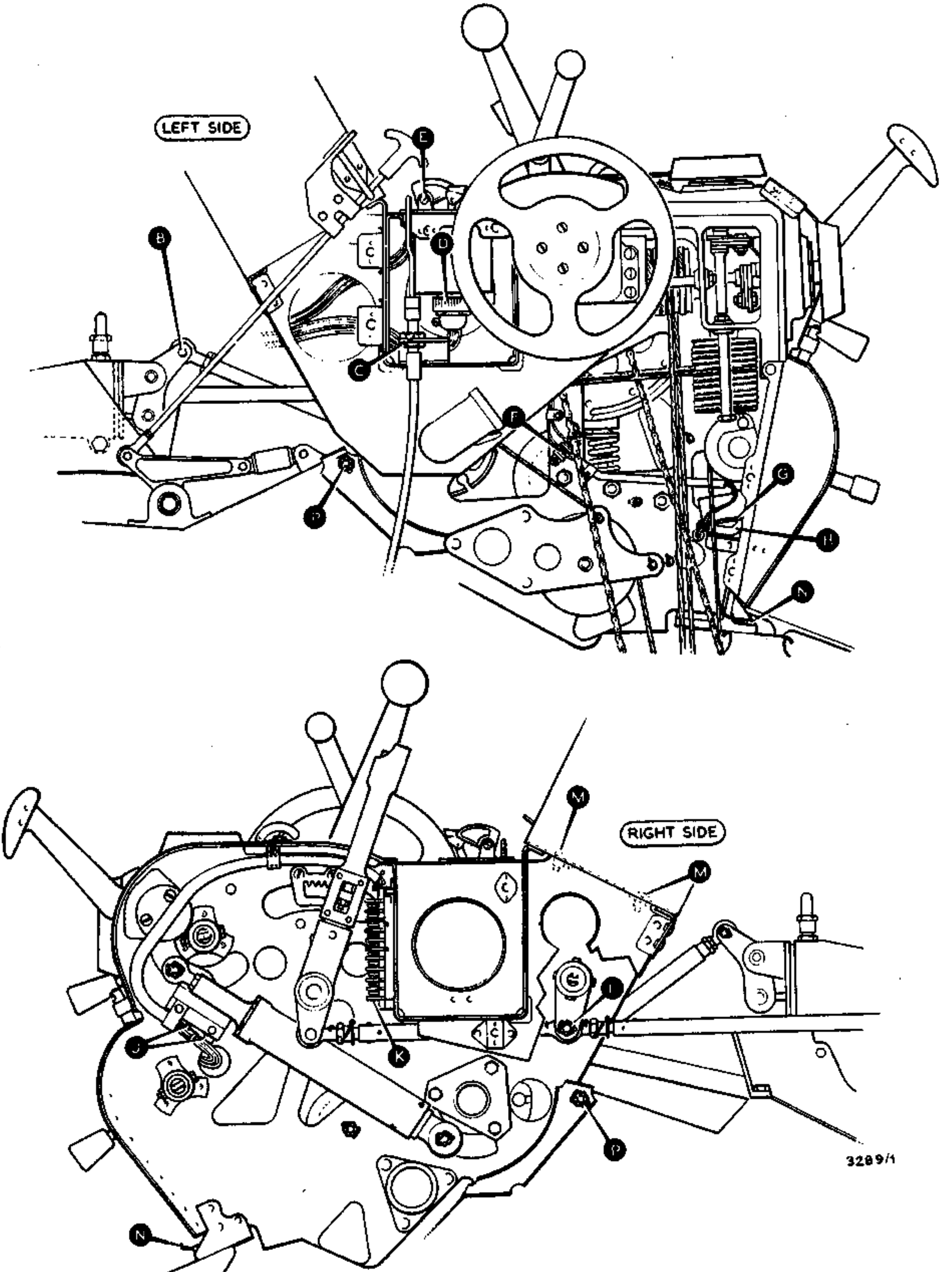
(14) Remove the left and right foot guards forward of the pedestal.

Below floor level

(15) Remove all cable guards at pulleys below pedestal.

(16) Disconnect the control cables at the turnbuckles and pull cables attached to the pedestal through the fairleads.

(17) Locate and disconnect link in elevator trim chain.



Control pedestal
Fig.201

...Control pedestal - Maintenance practices continued

Above floor level

(18) Remove the bolt, washer, nut and split pin and disconnect connecting rod at (B).

(19) Disengage nose undercarriage mechanical indicator from bracket (C) and remove Teleflex cable P -clips from side of pedestal.

(20) If autopilot and gyrosyn compass installations are fitted, disconnect cables at autopilot emergency disconnect switch (D) and gyrosyn compass switch (E).

(21) Disconnect cables at terminal block RR(K).

(22) Disconnect hand brake lever at (L).

(23) Remove bolts (M) securing radio controllers panel to pedestal.

(24) Remove the two bolts (N) securing the front of the pedestal, and the bolts, nuts and split pins (P) securing each side of the pedestal.

(25) Remove pedestal assembly.

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B. Install control pedestal

NOTE : If a new control pedestal is being installed, transfer the emergency hydraulic hand pump connecting rod (see para. A (18)) from the old pedestal.

(1) Secure control pedestal to floor structure (N) and (P). Wire-lock the two bolts securing the front of the pedestal and lock the two side nuts with split pins.

(2) Secure radio controllers panel to pedestal with bolts (M).

(3) Connect hand brake lever connecting rod (L) and rig hand brake controls (see Chapter 32).

(4) Connect cables to terminal block RR(K).

(5) If autopilot and gyrosyn compass installations are fitted, connect cables to autopilot emergency disconnect switch (D) and gyrosyn compass switch (E).

(6) Secure nose undercarriage mechanical indicator to bracket (C) at side of pedestal, tighten locknuts and wire-lock. Secure indicator Teleflex cable P -clips (see Chapter 32 for adjustment).

(7) Attach connecting rod to hydraulic pump (B) (see Chapter 29). Tighten nut and secure with split pin.

(8) Connect elevator trim chain and peen to lock the connecting link bolt.

(9) Connect all control cables and rig the associated systems in accordance with the instructions in the following chapters :-

Chapter 21 - Air conditioning
Chapter 27 - Flight controls
Chapter 28 - Fuel
Chapter 76 - Engine controls

(10) If a new or overhauled pedestal has been installed, the flap position indicator label, forward of the flap lever, will have been supplied undrilled. After rigging the flap system, position the label to suit flap positions and drill two No.41 holes in label to match the holes in the pedestal; countersink the holes 100° to 0.18 in. diameter.

(11) Fit all cable guards at pulleys.

(12) Fit all controllers removed in operation A.(11) (see Chapter 23 and Chapter 34).

(13) Fit pedestal side panels and lower front panel and refit all lever control knobs.

NOTE : To facilitate installation of left side panel, commence installation with panel rotated 90° back from installed attitude and feed in around the elevator trim control.

(14) Fit foot guard panels.

(15) Functionally test all systems disturbed during control pedestal removal.

(16) Fit flight compartment floor panels and secure rudder pedal adjuster unit rings and control column socks to floor panels (see Chapter 27, CONTROL COLUMN).

(17) Fit flight compartment step.

(18) Fit radio guard panel at side of left-hand pilot's seat.

(19) Fit access panels in vestibule.

(20) Fit flight compartment floor covering.

(21) Fit crew seats (see Chapter 25, CREW SEATS).

* * *

# CHAPTER

# 26

# FIRE PROTECTION

## Chapter 26

# FIRE PROTECTION

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| | 26-10-31 | Warning bell | Gents C396 |
| | | Warning bell assembly | BAe 25-7NF2257A (Mod 252730) |
| | 26-10-41 | HSRS overheat detector switches :- | |
| | | Rear equipment bay | Graviner 130D/3 or (Mod 252793) 150D/01/100 |
| | | Pylon fillet | Graviner 150D/01/150-2 |
| | | Bell relay | Magnetic Devices 596/TS/1688/1 |
| | | Bell isolation switch | Pye U525 |
| | | Test switches | Pye U530 |
| | | Engine fire warning lamps | Rotax H2702 |
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| | | HP cock warning lamp | Thorn 80/10/2528 red |
| | 26-15 | APU FIRE DETECTION AND WARNING | |
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| * | 26-15-11 | Fire detectors | |
| | See 26-10-31 | Warning bell | |
| | | Fire relay switch | Leach 9274/4024 |
| | | Changeover relay | Leach 9330/4026 |
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| | | Lampholder 'press-to-test' | Page C500 |
| | See 26-10-41 | Bell relay | |
| | 26-20 | FIRE EXTINGUISHING | |
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| * | 26-20-22 | Cartridge unit (main engine) | HTL3090000M |
| * | 26-20-31 | Pressure relief discharge indicator | Graviner A513 |
| * | 26-20-41 | Extinguisher fired indicator | Graviner A656MK3 |

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| | | Cartridge unit (a.p.u.) | Graviner 222A |
| | | Portable hand-operated extinguishers :- | |
| | | Pre Mod 252739 | Pyrene PA-BCF |
| | | Mod 252739 | F.F.E.(UK) Ltd. BA51015 |
| | | Engine extinguisher selector switches | Honeywell 2TL1-1 |
| | | Engine extinguisher selector switches (Mod 251834) | Honeywell 2TL1-7 |
| | | APU extinguisher selector switch | Lucas LHA2-BG207 |

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# FIRE PROTECTION - GENERAL

## 1. General

The fire protection equipment provides the following :-

(1) Detection and warning of fire in Zone 1 and Zone 2 of each engine.

(2) Fire extinguishing in Zone 1 of each engine.

(3) Detection and warning of fire in APU shrouds.

(4) Fire extinguishing in APU shrouds.

(5) Fire extinguishing within the aircraft.

(6) Rear equipment bay overheat warning.

(7) Pylon fillet overheat warning.

## 2. Detection

### A. Engine fire and overheat detection

Detection of fire in engine Zones 1 and 2 is by a pneumatic sensing capilliary type detector, providing high-speed detection of abnormally high temperature and rapid resetting to cancel the warning on zone temperature fall.

### B. Rear equipment bay and pylon fillet overheat detection

Detection in both areas is by thermally-operated automatically resetting switches which when operated, illuminate their relevant Master Warning System panel (MWS) annunciators in the flight compartment.

### C. APU fire detection

Fire detection at the APU is provided by a High Speed Re-setting (HSRS) detector circuit, giving high-speed detection of abnormally high temperature.

## 3. Fire extinguishing

### A. Engine Zone 1

A single, dual-head, extinguisher serves each engine Zone 1, providing a maximum of two shots to any one engine.

### B. APU shrouds

A single-head extinguisher serves two pipelines, one to the plenum chamber shroud and the other to the gear housing shroud.

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## C. Aircraft interior

A portable, hand-operated fire extinguisher is a standard fitment in the flight compartment; further portable extinguishers may be fitted in the passenger compartment to suit individual operator's requirements.

Visual indication of fire in engine zones 1 and 2 is by Central Attention Getting System (c.a.g.s.) flashers and by warning lamps; one on associated engine HP cock lever and one for each engine on FIRE section of roof panel CG. In addition, audible warning is provided by a bell. A Fire test switch for each engine is provided on TEST section of panel CG to facilitate test of electrical portion of fire detection circuit.

An overheat condition in the rear equipment bay is automatically indicated by the REAR BAY O/HEAT annunciator on centre instrument panel CC and by operation of the c.a.g.s. flashers.

An abnormally high temperature in either engine pylon fillet is detected by overheat switches which light PYLON O/HEAT annunciators on centre instrument panel CC.

Visual fire indication in the a.p.u. is given by a warning lamp on the a.p.u. control panel DE and simultaneous audible warning by a bell. A push test switch adjacent to the warning lamp is provided for testing the circuit.

* * *

## FIRE/OVERHEAT DETECTION AND WARNING - DESCRIPTION AND OPERATION

### 1. Engine Zones 1 and 2 (Fig.1)

### A. Description

Fire and overheat detection is provided by a single detector/sensor for Zones 1 and 2 of each engine. Each engine sensor is permanently connected to a responder which is pressure operated by the heated sensor to connect a d.c. electrical supply to the FIRE section of roof panel CG. Fire switches in TEST section of panel CG enable each detector responder-switch circuit to be electrically tested.

The sensor element is clamped to the engine casing using special clamps with Teflon split-bushes to protect the element from damage during clamping.

### B. Operation

The sensor element is a sealed stainless steel capillary tube which contains a core material capable of releasing a very large volume of gas when a certain temperature is exceeded. When the gas pressure in the element exceeds the preset value, a snap-action pressure switch in the responder assembly is closed and a 28 volt d.c. supply is directly connected to the associated FIRE warning lamp, HP cock warning lamp, Central Attention Getting System (c.a.g.s.) flashers and the firebell. The firebell is operable by the detector of either engine and can be cancelled by selecting the appropriate BELL ISOLATE switch. Operation of the c.a.g.s. flashers can be cancelled by the CANCEL switch on centre coaming panel. When the sensor element reverts to a normal temperature, the core material ceases to out-gas and the resultant reduced pressure at the detector cuts-off the 28 volt d.c. supply and cancels all fire alarms. No manual resetting is necessary and the detector system is ready for further warnings.

Operation of a FIRE TEST push switch on roof panel CG connects a d.c. supply to the self-test switch in the responder. This actuates the associated warning lamps, bell and flashers to electrically proof test these components and the interconnecting wiring.

### 2. Rear equipment bay (Fig.2)

### Description

Warning of overheating in the rear equipment bay is transmitted by the overheat switch circuit to Master Warning System panel (MWS) REAR BAY O/HEAT annunciator on pilots' centre instrument panel CC. These switches also simultaneously connect a supply to operate the c.a.g.s. panel flashers (centre coaming panel CY).

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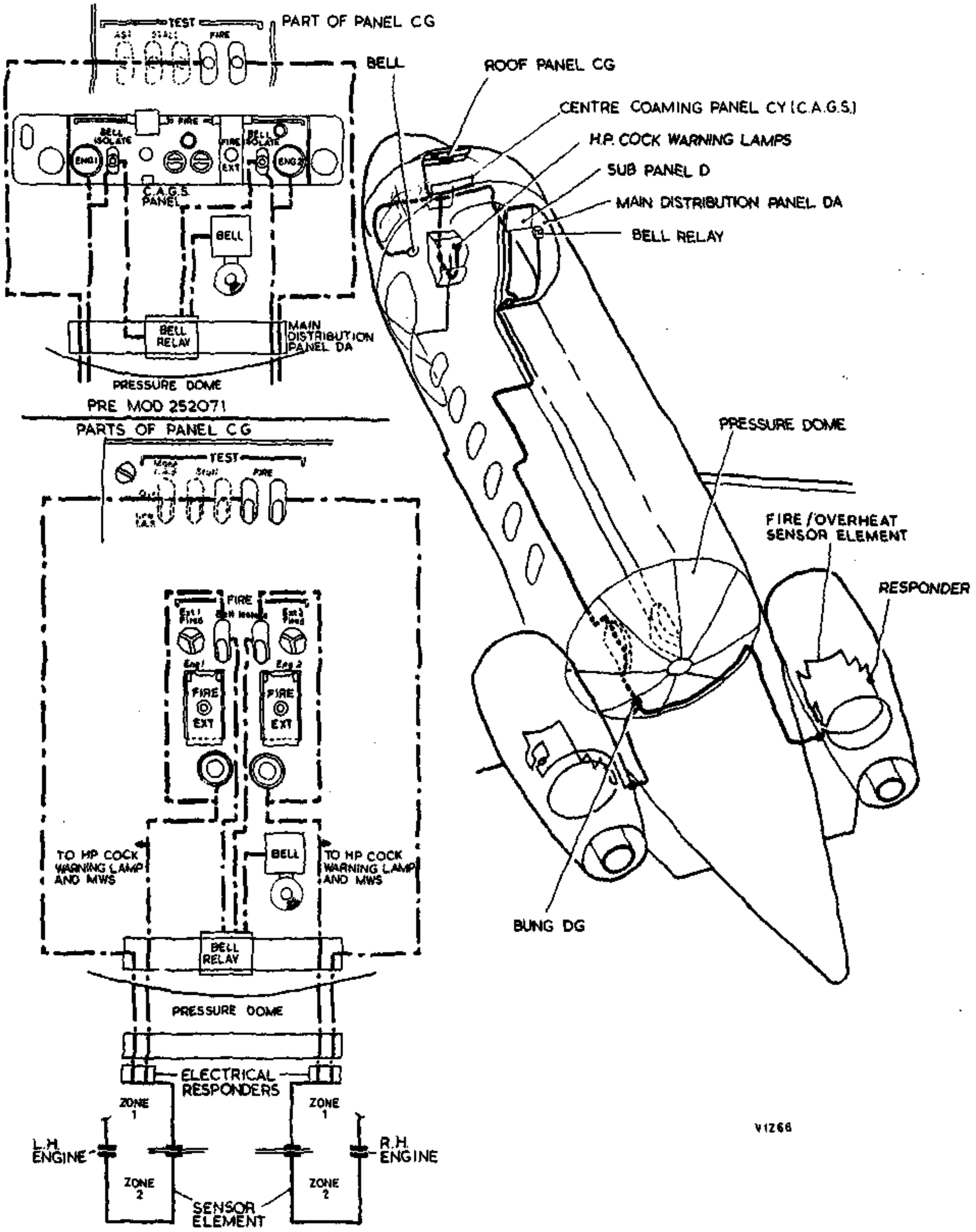
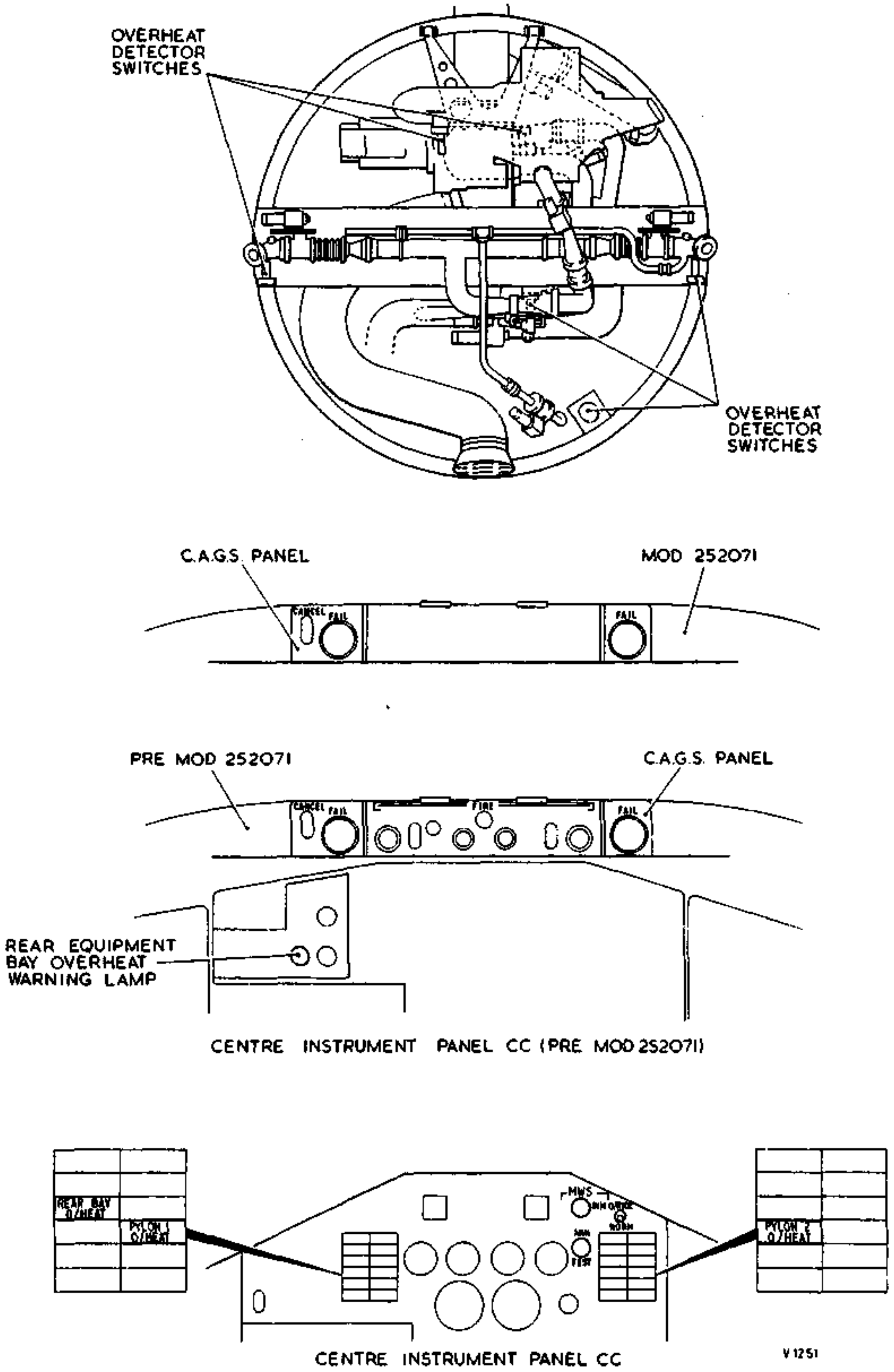


Fire detection and warning system
Fig.1


OVERHEAT DETECTOR SWITCHES
OVERHEAT DETECTOR SWITCHES
C.A.G.S. PANEL
MOD 252071
CANCEL
FAIL
FAIL
PRE MOD 252071
C.A.G.S. PANEL
CANCEL
FAIL
FIRE
FAIL
REAR EQUIPMENT BAY OVERHEAT WARNING LAMP
CENTRE INSTRUMENT PANEL CC (PRE MOD 252071)
REAR BAY O/HEAT
PYLON 1 O/HEAT
MWS
INH
OVRD
WARN
TEST
PYLON 2 O/HEAT
CENTRE INSTRUMENT PANEL CC
V1251

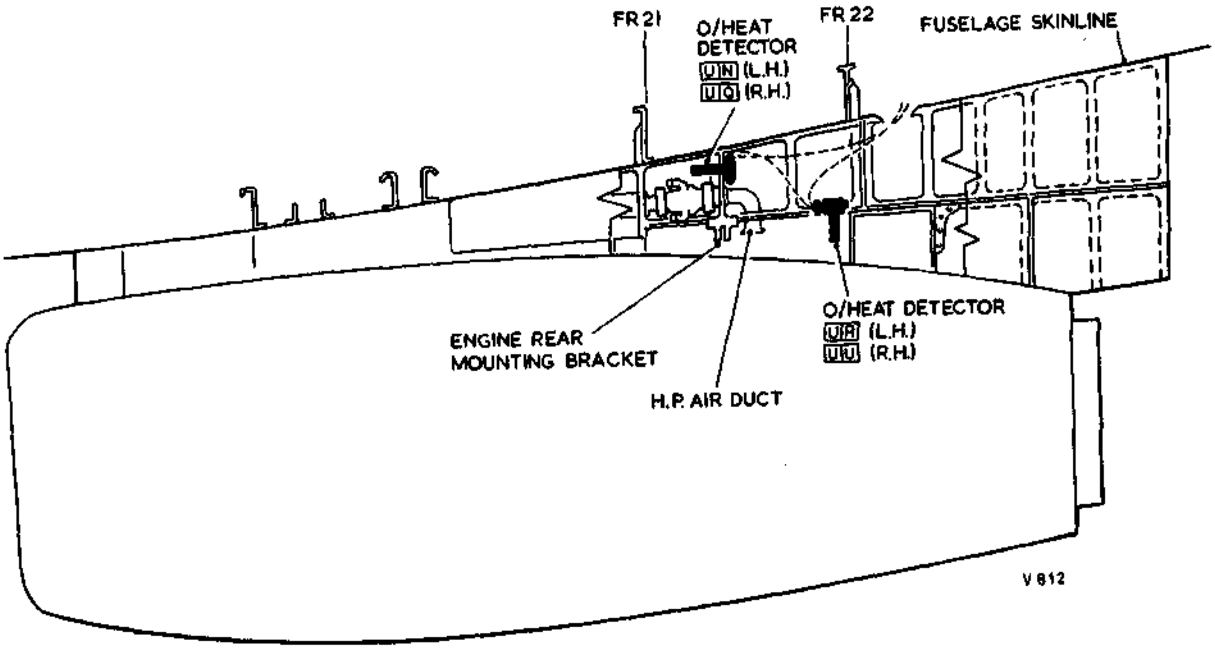
Installation of rear equipment bay
overheat detection system
Fig.2

## 3. Engine pylon fillets

### Description

Overheating in the engine pylon fillets is detected by two overheat switches in each fillet. The operation of any one switch will connect a supply to the Master Warning System panel (MWS) and illuminate the appropriate PYLON O/HEAT 1 or 2 annunciator and the c.a.g.s. flashers.

Overheat warning circuits for rear bay and pylon fillets can be tested using press/hold test switch ANN TEST on centre instrument panel CC .



Overheat detection system in LH engine pylon
(RH pylon similar)
Fig.3

## 4. Data

### Engine zones 1 and 2 only

| | |
|---|---|
| Detector sensor alarm temperature ... ... | 400°C |
| Detector sensor flame response ... ... | Up to five seconds |

### Rear equipment bay

| | |
|---|---|
| Overheat switch alarm temperature ... ... | 100°C ± 10°C |

### Engine pylon fillets

| | |
|---|---|
| Overheat switch alarm temperature ... ... | 150°C ± 10°C |

* * *

## FIRE/OVERHEAT DETECTION AND WARNING - TROUBLE SHOOTING

### ENGINE

Table 101

NOTE: Before any electrical fault is remedied, isolate aircraft electrical power supplies (see MAINTENANCE PRACTICES).

| Fault | Possible cause | Remedy |
|---|---|---|
| (1) Warning lamps fail to light and bell fails to operate when related test switch is operated. | (a) Faulty responder<br>(b) Low resistance leakage to ground due to contamination of responder connector.<br>(c) Tripped circuit breaker - labelled TEST-Fire LH or RH.<br>(d) Defective fuses F11 or F12 panel ZL.<br>(e) Open bell and lamp circuits. | See Fig.101.<br>Break down joint and examine for cleanliness. Clean contaminated points and test circuit.<br>Close circuit breaker<br>Fit new 3 amp. fuse(s)<br>Refer to (2) and (3) |
| (2) Warning lamps light but bell fails to operate when (a) fire is evident or (b) when related test switch is operated | (a) Open circuit between: Bell isolation switch and bell relay<br>Bell relay and bell<br>Bell and earth<br>(b) Tripped circuit breaker labelled FIRE WARN BELL<br>(c) Defective bell isolation switch<br>(d) Defective bell operating relay<br>(e) Defective bell | Make good all electrical connections<br>Close circuit breaker<br>Fit new switch<br>Fit new relay.<br>Adjust as necessary (see Chapter 26, WARNING BELL). |
| (3) Warning bell operates but lamps fail to light when (a) fire is evident or (b) when related test switch is operated. | (a) Defective lamp<br>(b) Open circuit between: Bell isolation switch and lamp<br>Lamp and earth | Check filament; if serviceable, fit new lamp<br>Make good all electrical connections |

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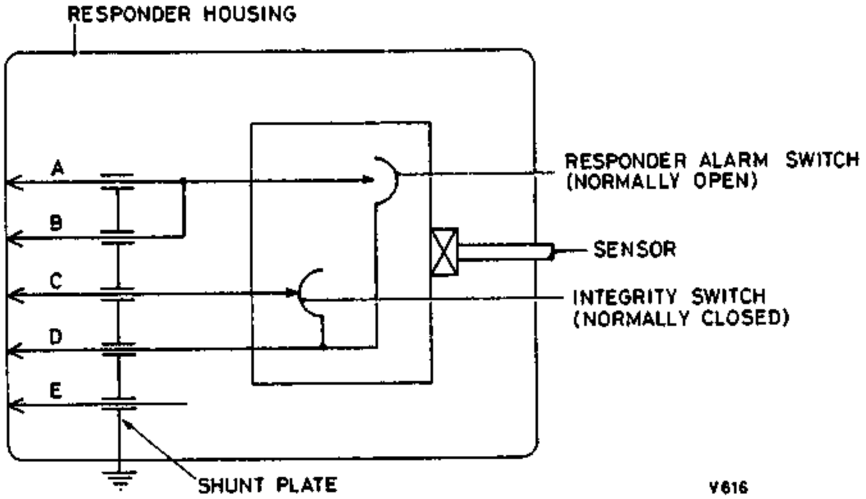

RESPONDER HOUSING
A
B
C
D
E
RESPONDER ALARM SWITCH (NORMALLY OPEN)
SENSOR
INTEGRITY SWITCH (NORMALLY CLOSED)
SHUNT PLATE
V616

Responder unit
Fig.101

The responder unit is electrically serviceable when a test meter connected to pins C and D shows there is continuity. Continuity should not exist between pins A and D at ambient temperatures.

## REAR EQUIPMENT BAY AND PYLON FILLET OVERHEAT DETECTION

Table 102

| Fault | Possible cause | Remedy |
|---|---|---|
| (1) Warning lamps fail to light when (a) ANN. TEST switch is depressed to test warning circuit or (b) when overheat is evident | (a) Tripped circuit breaker labelled REAR BAY OVERHEAT or Panel ZK fuses defective. | Close circuit breaker or check Panel ZK fuses F7 and F8. |
| | (b) Open circuit between : Supply and detector switches. Detector switches and warning lamp. | Make good all electrical connections. |
| | (c) Defective lamp. | Check filament; if serviceable, fit new lamp. |
| | (d) Defective detector switches. | Fit new switches as necessary. |
| (2) Warning lamp fails to extinguish when released from depressed condition, or remains on after overheat. | (a) Defective lamp | Fit new lamp |
| | (b) Faulty detector switch. | Isolate each switch, in turn remove faulty switch and fit new switch. |

* * *

## FIRE/OVERHEAT DETECTION AND WARNING - MAINTENANCE PRACTICES

### 1. Removal/Installation

Removal and installation of the majority of the fire detection units is self-evident. Units which warrant special instructions are dealt with under the Page 201 block of their subject numbers (refer to Chapter 26, Table of Contents). Where no specific instructions are given, always isolate the electrical power supplies before proceeding with removal or installation. Functionally test the system after installation.

### 2. Adjustment/Test

#### A. Functionally test engine fire overheat detection and warning system

(1) BATTERY switch - ON, or if ground power is connected :-
BATTERY switch - OFF
EXT POWER switch - ON

(2) Select and hold 1 FIRE TEST switch.

(3) Check that ENG 1 FIRE and left-hand H.P. COCK warning lamps come on, bell rings and c.a.g.s. flashers operate. Cancel c.a.g.s. flashers using CANCEL switch.

(4) Operate NO.1 BELL ISOLATE switch and check bell is cancelled.

(5) Reset BELL ISOLATE switch; check that bell rings.

(6) Release No.1 FIRE TEST switch and check that warning lamps go out.

(7) To ensure an engine cross-wire condition does not exist activate the following test:

(a) To isolate No.2 engine disconnect zone 1 fire overheat detector element.

(b) Repeat operations (2) to (6) above and ensure there is no reaction from the No.2 engine fire/overheat detection and warning system.

(c) Reconnect zone 1 fire overheat detector element.

(8) Repeat operations (2) to (7) for No.2 engine circuit carrying out cross-wire check (7) for No.1 engine.

(9) Press and hold No.1 FIRE TEST and No.2 FIRE TEST switches and check that ENG 1 FIRE and ENG 2 FIRE warning lamps light. Release FIRE TEST switches, cancel MWS and check warning lamps are extinguished.

(10) As appropriate, set BATTERY or EXT POWER switch OFF and switch 'off' and disconnect ground power.

#### B. Functionally test rear equipment bay overheat detection

Equipment required :

| | |
|---|---|
| Graviner heating tongs ... ... ... ... | IT279 or IT714 (24V supply)<br>IT1785 (110V supply) |

...Fire/overheat detection and warning - Maintenance practices continued

(1) BATTERY switch - On, or if ground power is connected :-

BATTERY switch - Off
EXT PWR - ON

CAUTION : DURING TEST SEQUENCE SHOULD ALL ANNUNCIATORS ILLUMINATE, A FAULT IN THE MWS SYSTEM (CIRCUIT BOARD 'A' TO REAR BAY O/HEAT OR PYLON 1 OR 2 O/HEAT ANNUNCIATOR) IS INDICATED AND THE APPROPRIATE TROUBLE SHOOTING ACTION MUST BE TAKEN (SEE CHAPTER 33, LIGHTS).

(2) Using heating tongs apply heat to overheat switch QW in rear equipment bay and check MWS REAR BAY O/HEAT annunciator lights and c.a.g.s. flashers are operating.

(3) Using Cancel switch, cancel the flashers. Remove heating tongs from overheat switch QW and check MWS annunciator extinguishes.

(4) Attach heating tongs to one of the two overheat switches in either pylon fillet, apply heat and check that either PYLON 1 or 2 O/HEAT MWS annunciator lights and that c.a.g.s. flashers are operating.

(5) Using Cancel switch, cancel the flashers and remove the heating tongs from the overheat switch. Check that MWS annunciator extinguishes.

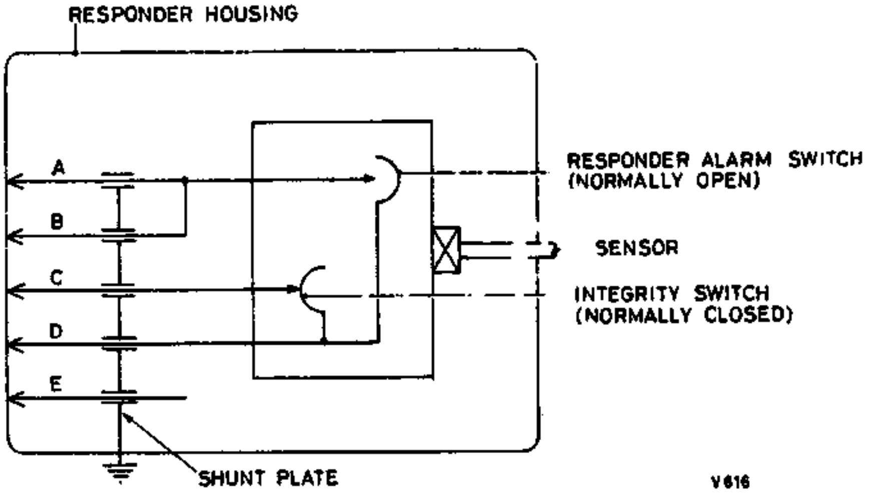
(6) As appropriate, set the BATTERY switch Off or switch Off and disconnect EXT PWR.

* * *

## ENGINE FIRE/OVERHEAT DETECTOR - DESCRIPTION AND OPERATION

### 1. Description

The Systron-Donner P/N 3001 is a continuous-length thermal fire/overheat detector. Each detector consists of a stainless steel housed responder assembly with a length of stainless steel sensor element permanently attached. The entire assembly is welded, brazed and hermetically sealed. Enclosed in the sealed responder housing is a 5-pin electrical connector and two pressure sensitive switches insulated in ceramic. The sensor is a braze sealed tube containing a special core material and pressurized inert gas. The detector operates on the pneumatic principle.


RESPONDER HOUSING
A
B
C
D
E
RESPONDER ALARM SWITCH (NORMALLY OPEN)
SENSOR
INTEGRITY SWITCH (NORMALLY CLOSED)
SHUNT PLATE
V616

Responder
Fig.1

When the gas pressure in the sensor element exceeds a preset value, a snap action pressure switch in the responder assembly closes, and + 28v d.c. is connected directly to the alarm system.

The increased gas pressure due to heating may be either by the averaging inert gas or by a small segment of the sensor being heated to a temperature where the core will outgas. The core outgassing is reversible and will return to its original state, clearing the alarm, when the temperature is reduced below the set trigger temperature. The detector can then be re-used repeatedly.

A second pressure switch within the responder housing serves as the integrity switch for the detector. It is held in the closed mode by factory set internal gas pressure. If the internal gas pressure is lost through a leak or other damage to the assembly which causes loss of pressure, this switch will open. The status of the integrity switch may be continuously checked by push-to-test means.

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...Engine fire overheat detector - Description and operation continued

The following describes the etched identification number system used on the detector.

PN 3001 - 31 - 900/400 - 17

Length (ft.)

Average alarm temp. (°F)

Discrete alarm temp. (°F)

Dash No. (configuration)

Basic Pt. No.

Temperature tolerances are ± 6%.

The detectors are hermetically sealed units. Any attempt at disassembly may cause serious damage, and is likely to render the unit inoperative.

2. Operation

The sensor element contains a gas-saturated metallic core, which is capable of releasing a large quantity of gas within the sealed detector assembly whenever the detector is heated above the discrete setting temperature. The discrete function of this heat sensitive core is to react to localized flame/heat, thus providing the internal gas pressure to close the alarm switch in the responder. This function is called the "discrete" heat sensing capability of even a small portion of the sensor. The area around the centre core within the sensor tube is also precharged with an inert gas. This second and free gas causes the arithmetic average response alarm. It follows the gas laws, i.e., a rise in temperature causes a corresponding rise in pressure. Thus, when an overall temperature rise above the detector's factory set-point is experienced, it causes the pressure switch to snap closed and operate the alarm system. This function is independent of the "discrete" feature; but the result of overheating the sensor under "averaging" or "discrete" conditions produces the same result by activating the detector alarm switch. This switch when closed allows 28 VDC to the system warning and control circuits.

* * *

## ENGINE FIRE/OVERHEAT DETECTOR - MAINTENANCE PRACTICES

NOTE: The detectors are hermetically sealed units, and as such are not repairable in the field. Any attempt to disassemble a detector in the field may cause serious damage to the unit, and is likely to render the unit inoperative.

### 1. Removal/Installation

Access to the detector is gained by removing:-

Zone 1: Lower hinged cowl and ) Refer to
upper bolted cowl. ) Chapter 71,
Zone 2: Rear bolted cowl. ) GENERAL

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#### A. Remove detector : Zones 1 and 2

(1) On panel ZL in rear equipment bay, remove fuse F11 for right-hand engine or F12 for left-hand engine (see Chapter 24, GENERAL).

(2) Unscrew electrical connector from the responder unit and withdraw connector.

(3) Unlock hinged clamps and clips used to attach the detector to the engine.

(4) Remove detector and retain all clamps and clips.

(5) Fit protective cap to responder termination fitting of the disconnected detector.

#### B. Install detector

(1) Examine electrical connections of responder for cleanliness and clean if necessary (refer to para. 3.A.).

(2) Locate the detector in its support clamps and clips in both zones. Ensure Teflon bushes are correctly fitted over elements at clamp locations.

(3) On panel ZL, refit fuses removed at Operation 1.A. (1).

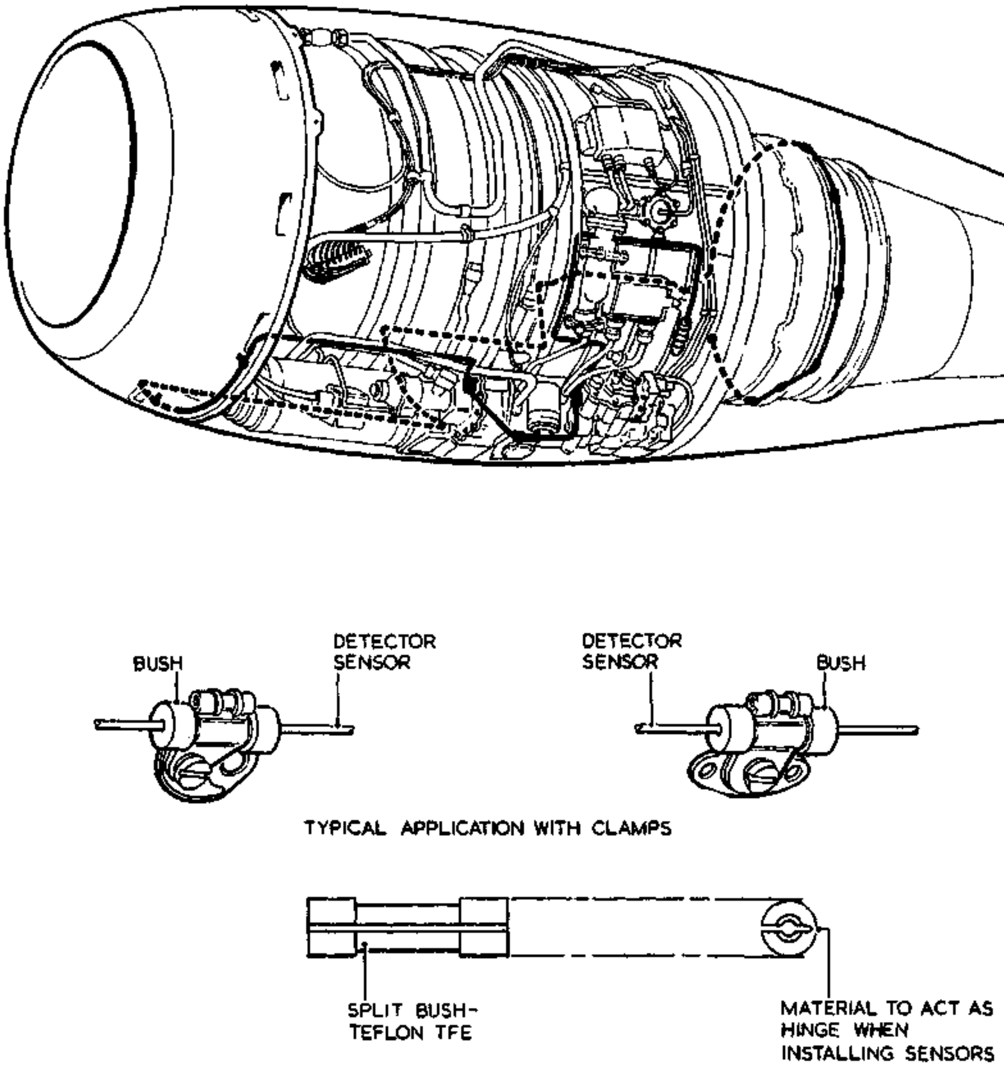
(4) Functionally test engine fire detection and warning system (see Chapter 26, FIRE/OVERHEAT DETECTION AND WARNING SYSTEM).

### 2. Adjustment/Test

#### A. Bench test detector

Equipment required:

Low voltage ohmmeter
Suitable convector oven.


BUSH
DETECTOR SENSOR
DETECTOR SENSOR
BUSH
TYPICAL APPLICATION WITH CLAMPS
SPLIT BUSH-TEFLON TFE
MATERIAL TO ACT AS HINGE WHEN INSTALLING SENSORS
V524

NOTE 1: MIN. BEND FOR DETECTOR ELEMENT TO BE 0.50 IN.

NOTE 2: MIN. CLEARANCE BETWEEN DETECTOR ELEMENT AND ENGINE COMPONENTS TO BE 0.30 IN.

Engine fire/overheat sensor
Fig.201

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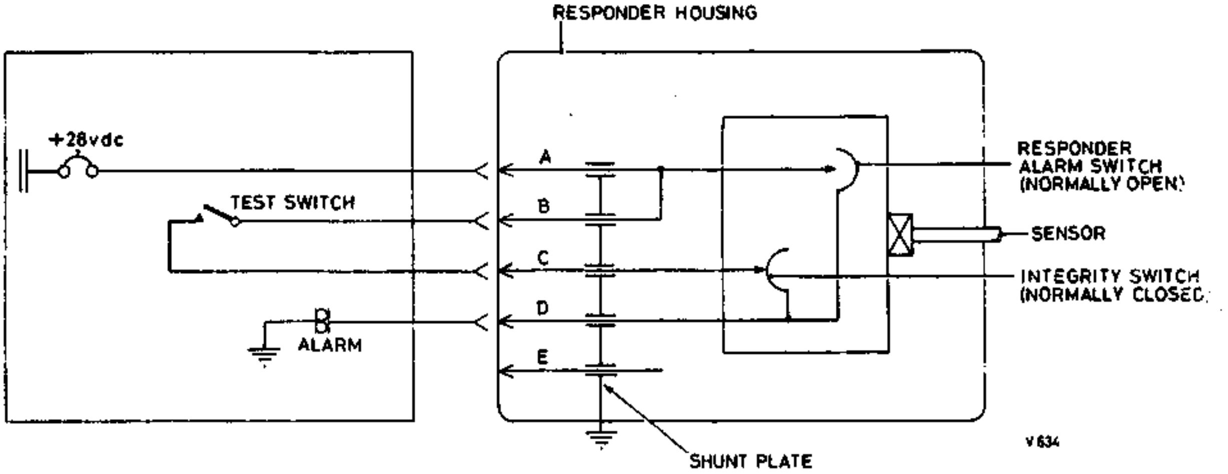
RESPONDER HOUSING
+28vdc
TEST SWITCH
ALARM
A
B
C
D
E
RESPONDER ALARM SWITCH (NORMALLY OPEN)
SENSOR
INTEGRITY SWITCH (NORMALLY CLOSED)
SHUNT PLATE
V634

Detector test
Fig.202

CAUTION: DO NOT ATTEMPT TO TEST THE DISCRETE OPERATION OF THE DETECTOR. THE FOLLOWING PROCEDURE ALLOWS TEST OF THE AVERAGING FUNCTION ONLY.

(1) Check for continuity across pins C and D in the responder connector end of the detector assembly, using a low voltage ohmmeter. If continuity is not present, further testing is unnecessary ... the unit is inoperative. If continuity is verified, the test may be continued.

(2) Mount unit in oven. Connect test lead wires to detector pins and run wires through oven vent (or bulkhead connector, if available) to bench area outside oven.

(3) Connect pin A to the + side of a 6 to 28v DC power supply, as convenient. Connect pin D in series with a 6 to 28 volt lamp, and then to the return (-) terminal of the power source.

(4) Start the oven, and set the temperature control dial between 5°F and 10°F below the minimum temperature for the specific detector.

NOTE: When starting the oven from room temperature, maintain the desired temperature for 20 minutes before starting test.

(5) Raise oven temperature by adjusting its control to increase temperature approximately 4°F and hold for two minutes.

ORIGINAL
As Received By
ATP

(6) Repeat sequence of operation (4) throughout tolerance range and up to a temperature of +5°F above the maximum tolerance limit. If the detector has not responded within the above limits, the unit is to be considered defective.

(7) Note the alarm temperature, then set the oven at "minimum" or "off", and check to determine that the detector resets (responder switch opens).

## 3. Cleaning/Painting

### A. Clean detector

CAUTION: WHEN HANDLING THE DETECTOR, DO NOT DAMAGE OR KINK THE SENSOR ELEMENT.

(1) All external surfaces of the detectors are of corrosion resistant steel and are hermetically sealed. Clean by dipping or wiping with any of the normally used degreasing agents or solvents such as kerosene, stoddard solvent, toluene, trichloroethane (Genklene) or industrial detergents. If the sensor tube is particularly coated with foreign material, clean off and polish with a wet steel wool scouring pad.

* * *

## WARNING BELL - MAINTENANCE PRACTICES

1. Adjustment/Test

A. Adjust bell (Fig.201)

(1) Remove bell dome and slacken castellated locknut.

(2) Set BATTERY switch ON.

(3) On roof panel, press either FIRE TEST switch. Cancel c.a.g.s. flashers.

(4) Adjust the contact screw to obtain best striker frequency.

(5) Tighten castellated locknut.

(6) Release the FIRE TEST switch.

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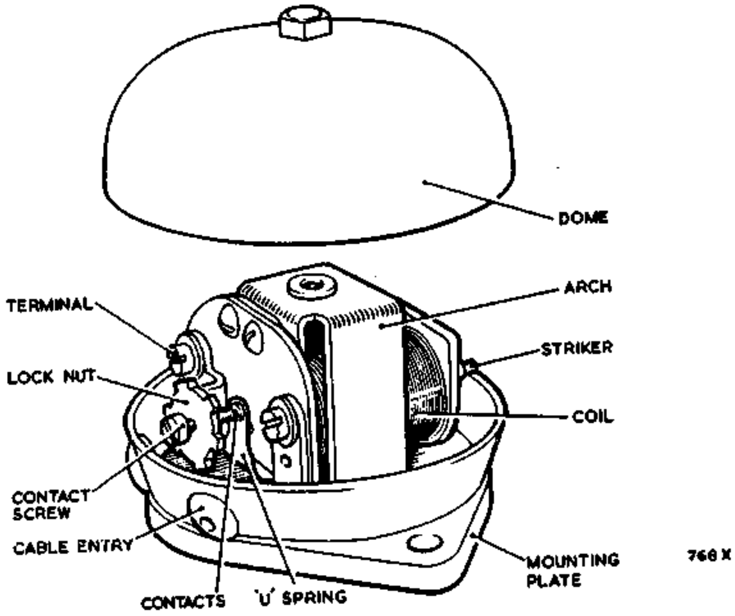


Warning bell
Fig.201

(7) Refit bell dome, leaving securing screw slack.

(8) Press FIRE TEST switch. Cancel c.a.g.s. flashers.

(9) Turn bell dome to obtain the best ringing note and tighten securing screw.

(10) Release FIRE TEST switch.

(11) Set BATTERY switch OFF.

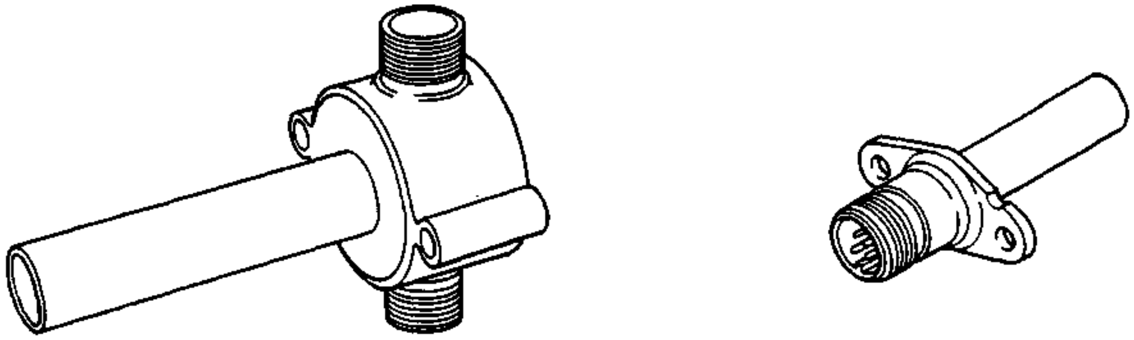
* * *

# HSRS DETECTOR SWITCH - DESCRIPTION, OPERATION AND DATA

## 1. Description

The High Speed Re-Setting (HSRS) detector switch is a heat sensitive thermally-operated switch, which operates to give warning of abnormally high temperature existing in the vicinity of its installed position, and to reset and cancel the warning system, when the overheat condition is cleared.

The HSRS switch, consists of a pair of spring bows, each spring embodying an electrical contact normally held apart, and enclosed with a steel barrel. The tube-mounted switch is provided with a base mounted cable entry, and base plate removal exposes a terminal block for electrical connections. The flange-mounted type has a screw-on plug and socket type of electrical connection.


DETECTOR (SERIES 3)
TUBE-MOUNTED TYPE

DETECTOR (SERIES 5)
FLANGE-MOUNTED TYPE

Typical HSRS detector switches
Fig.1

## 2. Operation

When the temperature rises to the switch operating level, the switch barrel expands and allows the electrical contacts to close and light the warning lamp in the flight compartment. When the temperature falls, the switch contacts open and cancel the warning. The switch is then automatically ready for further warnings.

## 3. Data

| Detector/switch type | Location | Operating temperature | Permissible tolerance |
|---|---|---|---|
| 130D/3 or (Mod. 252793)150D/01/100 | Rear equipment bay | 100°C | ± 10°C |
| 53183-105 | H.P. Air duct | 315°C | ± 15°C |
| 150D/01/150-2 | Pylon fillets | 150°C | ± 10°C |

# HSRS DETECTOR SWITCH - MAINTENANCE PRACTICES

## 1. Removal/Installation

Equipment and materials required:

| | |
|---|---|
| Solvent ... ... ... ... ... ... ... | Methylethylketone (MEK) |
| 500 volt installation resistance tester. | |

### A. Remove HSRS detector switch

(1) On panel DA/E trip circuit breaker REAR BAY OVERHEAT (grid ref.C6). On panel ZK, remove fuses F7 or F8 respectively l.h. and r.h. pylon fillets overheat detectors, as required (see Chapter 24, GENERAL).

(2) Remove switch securing bolts, and collect distance pieces and nuts where fitted.

(3) Support switch to ensure no strain is exerted on switch cables, release switch base securing attachments and remove base plate.

NOTE: In some installations it may be necessary to remove switch cable loom clips, to facilitate switch position manoeuvre, to gain access to switch electrical connections through the base plate.

(4) Disconnect electrical connections, unscrew cable gland nuts, withdraw cables from cable entries and remove switch.

### B. Check/Tests before installation

(1) Check HSRS switch is clean, dry and free from damage and corrosion. Small dents are permissible, but if HSRS switch is cracked, it must be renewed.

CAUTION: USE SOLVENTS AS SPARINGLY AS POSSIBLE, TAKING CARE NOT TO CONTAMINATE ELECTRICAL CONNECTIONS. WHEN CLEANING IS COMPLETED ALLOW AT LEAST 10 MINUTES FOR ANY SOLVENT RESIDUE TO DRY OUT.

(2) Remove oil, grease, swarf or other contamination matter from the HSRS switch exterior with solvent, if required.

(3) As required, clean terminal block and terminals. If terminal block is damaged, renew HSRS switch.

(4) Effect an insulation resistance test (see para.2).

### C. Install HSRS detector switch

(1) With the switch base plate removed, route the electrical cables through switch cable entries, and secure cable gland nuts.

(2) Connect and secure electrical connections, fit and secure base plate with attachments.

(3) Locate switch on structure, fit distance pieces and nuts where applicable, and secure switch to structure with bolts.

(4) If applicable, secure cable with clips.

(5) Reset circuit breaker or fit fuse(s) as applicable.

(6) Functionally test relevant circuit (see Chapter 26, ENGINE FIRE/OVERHEAT DETECTION AND WARNING).

## 2. Adjustment/Test

### A. Insulation resistance test

(1) Isolate the relevant electrical circuit (see para. 1.A. (1)) and disconnect external wiring.

(2) Using a 500 volt insulation resistance tester, check that the insulation resistance between each terminal and case is not less than 20 megohms.

(3) Reconnect the external wiring, and restore the electrical circuit.

(4) Functionally test the relevant circuit (see Chapter 26, ENGINE FIRE/OVERHEAT DETECTION AND WARNING).

* * *

# APU FIRE DETECTION AND WARNING - DESCRIPTION AND OPERATION

## 1. Fire detection circuit

### A. Description

Fire detection for the APU is provided by three Graviner detectors connected in parallel. An additional cable provides a fail-safe circuit. Two of the detectors, operating between 330°C and 360°C, are located on upper and lower plenum chamber shrouds and the other, operating between 230°C and 260°C, is located on the gear housing shroud. The detectors are connected to the PE busbar. A warning lamp and FIRE TEST switch are located on the APU control panel on the flight compartment left-hand bulkhead. The circuit is connected to the bell relay of the engine firewire circuit (see Chapter 26, ENGINE FIRE DETECTION AND WARNING).

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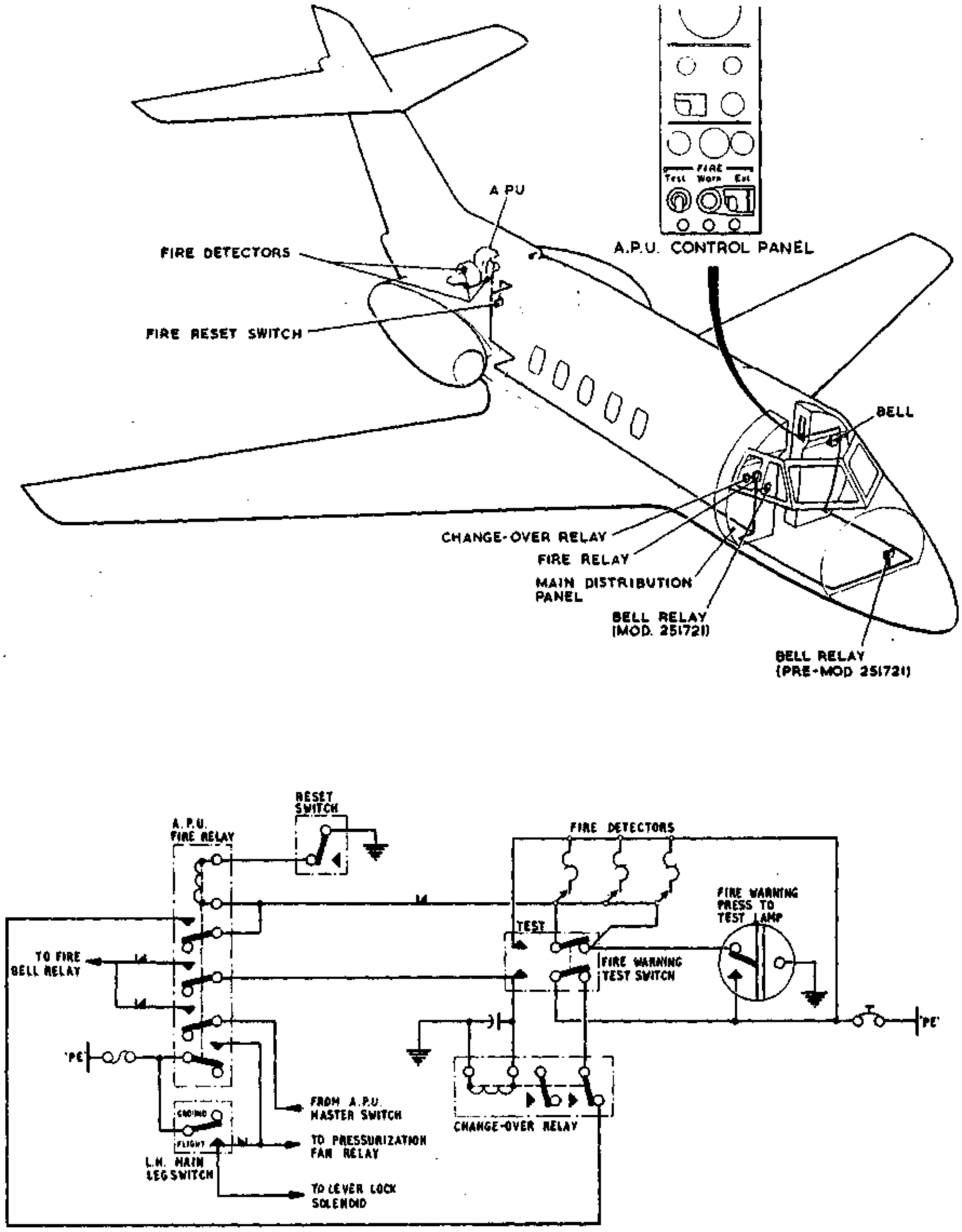
### B. Operation

When ambient temperature rises to detector operating temperature, longitudinal expansion of an alloy-steel barrel allows contacts to complete a circuit to the warning lamp. At the same time a fire relay is energized to actuate the fire warning bell and cause power to be cut off from the APU. Cancellation of the warning and restoration of power supplies to APU is by operation of the reset switch in the rear equipment bay. The detector works on the differential principle so that contacts will close below set operating temperature if detector is subjected to a rapid rate of temperature rise.

Operation of the TEST switch connects a supply to the fire relay which in turn actuates bell and lamp. The bell and lamp are cancelled by allowing the TEST switch to return to the normal position.

### C. Data

| Detector/Switch type | Location | Operating temperature | Permissible tolerance |
|---|---|---|---|
| 42D/3 or (Mod.252793) 150D/06/330 | Plenum chamber | 330°C | +30°C -0°C |
| 18D/3 or (Mod,252793) 150D/01/230 | Gear housing | 230°C | +30°C -0°C |



APU fire detection and warning
Fig.1

* * *

## APU FIRE DETECTION AND WARNING - MAINTENANCE PRACTICES

### 1. Removal/Installation

Removal and installation of the majority of the fire detection units is self-evident. Units which warrant special instructions are dealt with under the Page 201 block of their subject numbers (refer to Chapter 26, Table of Contents). Where no specific instructions are given, always isolate the electrical power supplies before proceeding with removal or installation, and functionally test the system after installation.

### 2. Adjustment/Test

A. Functionally test APU fire detection and warning system

(1) Set BATTERY switch to ON, or EXT POWER switch ON if ground power available.

(2) Operate FIRE TEST switch and check that warning lamp comes on and bell rings.

(3) Release FIRE TEST switch, and check that lamp and bell are cancelled.

(4) As appropriate, select BATTERY or EXT POWER switch off and disconnect ground power supply.

* * *

# FIRE DETECTORS - MAINTENANCE PRACTICES

## 1. Removal/Installation

Gain access to APU through access door under fuselage.

### A. Remove detector

(1) At panel DA/C trip circuit breaker APU FIRE WARNING (grid ref.H1) (see Chapter 24, GENERAL).

(2) Disconnect cable gland nuts at detector mounting base.

(3) Remove screws securing mounting base of detector to APU shroud and withdraw detector.

### B. Install detector

(1) Examine detector and gland nuts for cleanliness; clean as necessary.

(2) Position detector and secure mounting base to shroud with two screws and washers.

(3) Reconnect gland nuts onto detector cable-entry ports.

(4) Reset circuit breaker (see para. 1.A.(1)).

(5) Functionally test APU fire detection and warning system (see Chapter 26, APU FIRE DETECTION AND WARNING).

## 2. Adjustment/Test

### A. Test detector insulation resistance

(1) Remove mounting base cover plate.

(2) Using a 500-volt insulation tester, measure the resistance between each terminal and the case. It must not be less than 20 megohms in both tests.

(3) Refit mounting base cover plate.

* * *

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## FIRE EXTINGUISHING - DESCRIPTION AND OPERATION

### 1. Engine Zone 1

#### A. Description

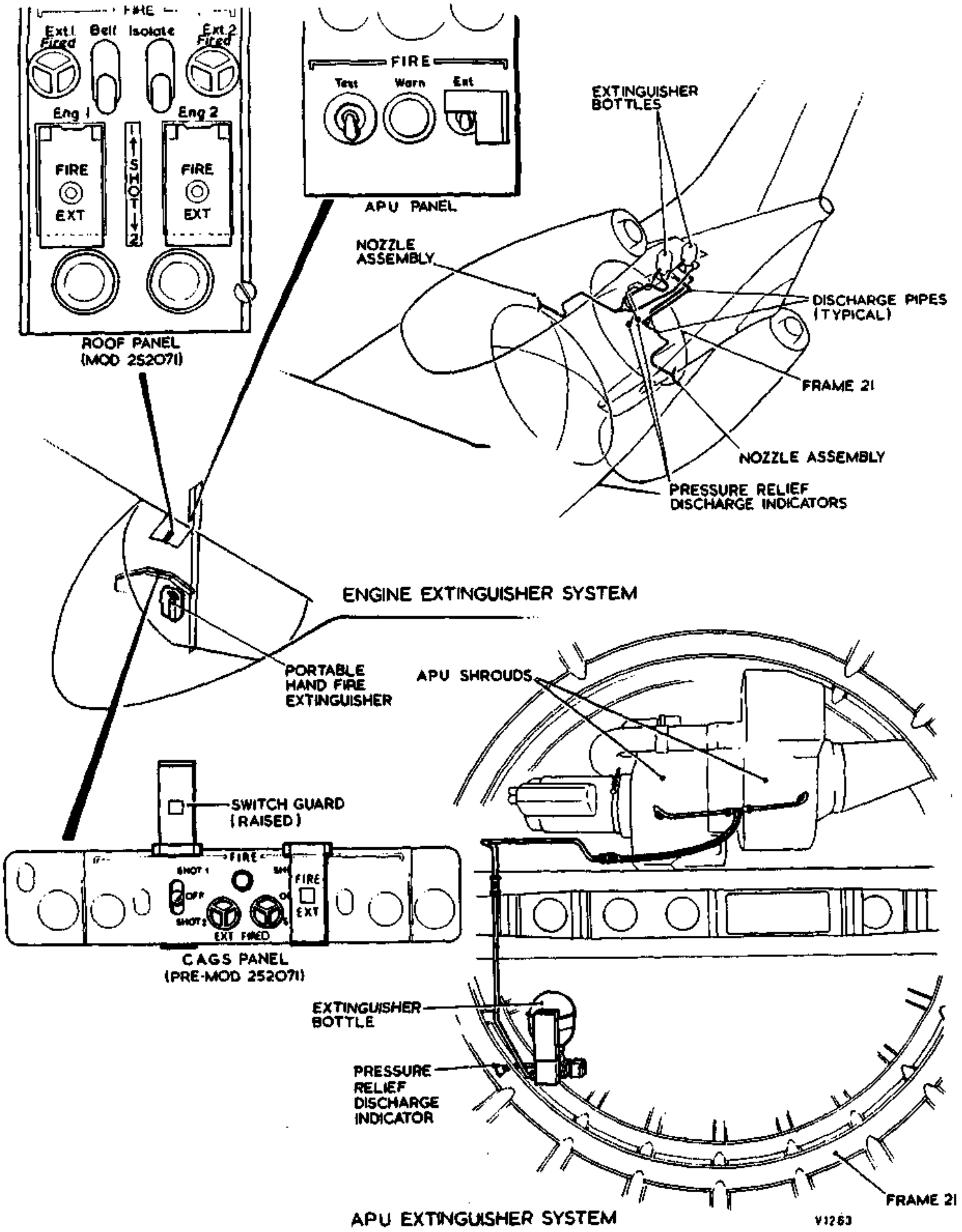
Engine Zone 1 fire extinguishant is supplied from two dual-head, single-shot extinguisher bottles and distributed by pipes with spray nozzles attached to the pylon. This system arrangement provides a maximum of two shots to any one engine (See Fig.1). Discharge of a bottle is achieved by a cartridge which is electrically fired using one of the 2-pole rocker selector switches on the flight compartment roof mounted FIRE panel. Each bottle is equipped with a connection incorporating an integral safety disc to provide overpressure protection. This connection is also used as the connection point for the bottle discharged indicator piping. The other end of the pipe is connected to a pressure relief discharge indicator which consists of a circular light alloy bowl fitted with a polythene plug and green nylon disc. The indicator is riveted to the rear equipment bay skin such that the bowl rim is flush with the skin and the green disc is visible from outside the aircraft. Should the ambient temperature exceed the upper limit for the extinguisher, the safety disc will burst, allowing extinguishant to flow to the pressure relief discharge indicator and impel the plug from the bowl orifice, thereby blowing out the green disc to reveal the bright red interior of the bowl; the safety disc may also rupture during intentional discharge but the resultant loss of extinguishant being negligible.

Bottle availability is indicated on the FIRE panel by two transparent fusible indicators which turn red when a SHOT has been selected.

On aircraft Post Mod.253543A, both extinguisher bottles are equipped with a visual contents pressure gauge. The pressure gauges have a red and green colour band: The red band indicates an unserviceable pressure between 0 to 550 PSIG at +70°F (+21°C). The green band indicates a serviceable pressure between 550 to 650 PSIG at +70°F (+21°C). For temperatures other than +70°F reference must be made to the temperature/ pressure data plates. One data plate is installed on each extinguisher bottle (which are difficult to read on installed bottles) and another on the adjacent aircraft structure (for easy reading).

#### B. Pipelines and couplings

All interconnecting pipes are fabricated in stainless steel with MS threaded union nuts for all discharge pipelines. The stainless steel indicator pipelines have standard British (BSP) collars and union nuts except for their connections to the bottles which has an MS threaded union nut. The extinguishant is directed around the engine by a forked fan-tailed spray nozzle attached to the engine pylon, adjacent to the firewall pocket, in the engine Zone 1 area.



Fire extinguisher systems
Fig.1

### C. Operation

With either selector switch positioned to SHOT 1 or SHOT 2, a circuit is made to fire the relevant cartridge unit, and a second circuit is made to fuse the relevant EXT FIRED indicator. The high pressure created by the cartridge charge ruptures a disc between the charge and the discharge outlet and releases the extinguishant to pass through the outlet and into the distributing pipelines to be discharged in the relevant engine Zone 1.

NOTE: SHOT 1 selection to an engine will completely discharge an extinguisher bottle leaving either a SHOT 2 to the same engine or a SHOT 1 to the other engine.

## 2. Auxiliary Power Unit (APU)

### A. Shrouds

Extinguishant for APU shrouds is supplied from an extinguisher bottle which is discharged by the firing of a cartridge unit, electrically operated from a selector switch on the APU control panel on the left-hand flight compartment bulkhead. The switch is protected by a hinged cover to prevent inadvertent operation. Operation of the bottle and pressure relief device are similar to that of the engine fire extinguisher bottles.

### B. Extinguisher bottle

For health and safety reasons new build and repaired Graviner extinguisher bottles are fitted with an anti-recoil cap installed in the junction box outlet. The recoil cap must remain fitted until final installation in the aircraft and must be retained and refitted whenever the extinguisher is removed from the aircraft.

The "FW" weight stamped on the head of the extinguisher includes the anti-recoil cap weight. All extinguishers whose stamped weight includes the anti-recoil cap have a letter "M" stamped in the serial number on the head of the extinguisher. If an extinguisher is removed for "check weighing" (Ref.AMM 26-20-51) and the weight stamped on the head does not include anti-recoil caps, the caps must remain fitted and an allowance of 0.37 oz. (10.7 grammes) be made.

## 3. Aircraft interior

Bromochlorodifluoromethane (BCF) fire extinguishant for the pressurized portion of the aircraft interior is supplied from a portable hand fire extinguisher (see Fig.1) which provides intermittent or continuous discharge of its contents by the operation of a lever or trigger. Pre Mod.252739, pressure indication of the Pyrene extinguisher contents is provided by a press-to-test diaphragm at the base of the extinguisher. Mod.252739; this extinguisher is serviceable if the red FULL indicator disc is not fractured. Operational instructions are labelled on both extinguishers. Additional, BCF or waterglycol, hand-operated extinguishers are installed to customer's requirements.

## 4. Data

Engine dual head fire extinguisher:

| | |
|---|---|
| Type | HTL/Pacific Scientific 33200002 (Pre-Mod.253543A) or 33200009 (Mod.253543A) |
| Contents | 4 lb (1.8 Kg) of Bromotrifluoromethane, BTM/$CF_3Br$/Freon 13B1 pressurized by dry nitrogen to between 600 and 625 psi (41.4 and 43.1 bar) at 21.1°C (70°F). |
| Maximum permissible loss - Actual weight/weight marked on container identification plate | ±0.10 lb (±0.04 Kg). |

APU fire extinguisher:

| | |
|---|---|
| Type | Graviner 182A |
| Contents | 2 lb of Bromochlorodifluoromethane pressurized by dry nitrogen to 250 psi at 0°C. |
| Maximum permissible loss against weight (less cartridge units) marked on operating head | 1 oz. |
| Cartridge unit | |
| Type | Graviner 222A |

Portable, hand-operated fire extinguishers:

| | |
|---|---|
| Type | Graviner 28H |
| Contents | 1.5 waterglycol. |
| Type (Pre-Mod.252739) | Pyrene PA-BCF |
| Contents | 2.88 lb of Bromochlorodifluoromethane (BCF). |
| Type (Mod.252739) | F.F.E.(UK) Ltd. BA 51015 |
| Contents and gross weight | 1.5 Kg BCF, ±10 grammes of labelled weight. |

NOTE: For health and safety reasons new build and repaired Graviner extinguisher bottles are fitted with an anti-recoil cap installed in the junction box outlet. The recoil cap must remain fitted until final installation in the aircraft and must be retained and refitted whenever the extinguisher is removed from the aircraft. The "FW" weight stamped on the head of the extinguisher includes the anti-recoil cap weight. All extinguishers whose stamped weight includes the anti-recoil cap have a letter "M" stamped in the serial number on the head of the extinguisher. If an extinguisher is removed for "check weighing" and the weight stamped on the head does not include anti-recoil caps, the caps must remain fitted and the following allowances made:
- 1.26 oz. (35.7 grammes) engine dual head extinguisher
- 0.37 oz. (10.7 grammes) APU extinguisher.

## FIRE EXTINGUISHING - MAINTENANCE PRACTICES

### 1. Removal/Installation

WARNING : WHEN REMOVING CARTRIDGE UNITS AND FIRE EXTINGUISHERS WHICH HAVE NOT BEEN DISCHARGED, HANDLE WITH CARE.

Removal and installation of the majority of fire extinguisher units is self-evident. Units which require special instructions are dealt with under the Page 201 block of their respective subject numbers (refer to Chapter 26, Table of Contents). Where no specific instructions are given, observe the following basic principles.

(1) Isolate relevant electrical circuits before removal and installation of units.

(2) Blank off all disconnected pipelines.

(3) When disturbed pipelines have been reconnected, disconnect supply pipelines at extinguisher heads and connect an air supply to the pipelines. Check all unions for leaks and check that spray fan-tails are clear.

### 2. Adjustment/Test

CAUTION: INCORRECTLY RATED FILAMENT LAMPS FITTED TO THE "EXT FIRED" INDICATOR ADAPTER, COULD LEAD TO A HIGH START-UP SURGE CURRENT THROUGH THE ISOLATION DIODES IN THE INDICATOR CIRCUIT, WHICH MAY DAMAGE THE DIODES, CAUSING INCORRECT SYSTEM OPERATION.
THE FILAMENT LAMP RATING MUST NOT BE GREATER THAN 2.8 WATTS.
HIGH VOLTAGE MEGGER EQUIPMENT (USED FOR CONTINUITY TESTING) MUST NOT BE USED.

Equipment required :-

Test lamps (cartridge units)
Test lamps (Maximum rating of 2.8 watts)(EXT FIRED indicators)
Adapter - EXT. FIRED indicator
Safety ohmmeter (max.output current 13mA)

#### A. Functionally test engine fire extinguishing circuit

(1) Ensure all d.c. busbars are de-energized (see Chapter 24 GENERAL). Also on Panel DA/D trip circuit breakers FIRE EXT No.1 (grid ref. B10) and FIRE EXT No.2 (grid ref. B11) (see Chapter 24, GENERAL).

WARNING : TO AVOID INCORRECT RECONNECTION, MAKE CERTAIN THAT LEADS TO EXTINGUISHER CARTRIDGES ARE CLEARLY IDENTIFIED BEFORE REMOVAL. FOR DETAILS OF ELECTRICAL WIRING TO FIRE EXTINGUISHERS, REFER TO AIRCRAFT ELECTRICAL ROUTING CHART NO.25-F4-NA5/*22 AND AMM CHAPTER 26-20-12.

(2) Disconnect leads from four extinguisher cartridge units.

(3) Remove both fuses from EXT FIRED indicators on roof panel CG.

(4) Secure test lamps and adapters in EXT FIRED indicators.

(5) Connect test lamps to leads removed from extinguisher cartridge units.

NOTE: Four test lamps must be used (one in each connector) in order to prove the serviceability of the diodes.

(6) Reset circuit breakers (Para. 2A. (1)) and energise d.c. busbars.

(7) Test the fire extinguishing circuit, operating the relevant fire extinguisher switches as follows :

| Fire extinguisher switch | EXT FIRED indicator illuminated | Test lamp illuminated |
|---|---|---|
| ENG 1 : SHOT 1 | L.H. | Bottle 1 (GH) head A |
| ENG 1 : SHOT 2 | R.H. | Bottle 2 (GJ) head B |
| ENG 2 : SHOT 1 | R.H. | Bottle 2 (GJ) head A |
| ENG 2 : SHOT 2 | L.H. | Bottle 1 (GH) head B |

NOTE : Ensure that the test lamps go out in the transition period between SHOT 1 and SHOT 2 selections.

(8) De-energize d.c. busbars and on panel DA/D, trip circuit breakers FIRE EXT No.1 (grid ref.B10) and FIRE EXT No.2 (grid ref.B11) (See Chapter 24, GENERAL).

WARNING : CONNECT LEADS TO EXTINGUISHER CARTRIDGES ONE AT A TIME TO ENSURE CORRECT CONNECTION.

(9) Disconnect all test lamps and ensure all leads are insulated. Perform the following operations :

(a) Locate on panel DA the four blocking diodes feeding the EXT FIRED indicators (Refer to the relevant Routing Chart).

(b) Perform a test on each diode with the safety ohmmeter to determine that the conduction occurs in one direction only, reverse connection should indicate open circuit.

CAUTION : PRIOR TO THE TEST MAKE SURE THE SAFETY OHMMETER USED HAS AN OPEN CIRCUIT VOLTAGE WHICH IS CAPABLE OF TURNING ON SILICON DIODES, i.e. >IV.

Replace the diode if its found to be defective then repeat operations A.(4) to A.(9) inclusive. Reconnect and test the extinguisher cartridges as detailed in operation A.(10).

(10) Connect aircraft leads to relevant extinguisher cartridge units as shown on AMM 26-20-12, Fig.201 and AMM 26-20-12, Table 201. Secure electrical connectors to cartridge units using 0.8mm stainless steel corrosion resistant locking wire. Remove test lamps and adapters from EXT FIRED indicators.

(11) Refer to Aircraft Electrical Routing Chart 25-F4-NA5/*22. Connect safety ohmmeter (maximum output current 13mA) between circuit breaker FIRE EXT No.1 (grid ref. B10) terminal 2 and earth.

(12) Operate relevant fire extinguisher switch (see operation (7)) and check for circuit continuity, a reading of 1.5-2.0 ohms should be obtained for each switch selection.

(13) Repeat operations (11) and (12) for circuit breaker FIRE EXT No.2 (grid ref.B11).

(14) Ensure that both fire extinguisher switches are at the centre-off position.

(15) Fit fuses to EXT FIRED indicators and secure with caps.

(16) Reset fire extinguishing circuit breakers.

B. Functionally test APU fire extinguisher circuits

(1) Ensure all d.c. busbars are de-energized (Chapter 24, GENERAL). Also, on panel DA/C trip circuit breaker APU FIRE EXT (grid ref.H1).

(2) Disconnect leads from extinguisher cartridge unit, and connect to a test lamp.

(3) Reset circuit breaker and energise d.c. busbars (Chapter 24, GENERAL).

(4) Operate extinguisher selector switch, and check that test lamp lights. Return selector switch to central off position, and check that test lamp extinguishes.

(5) De-energize d.c. busbars and on panel DA/C trip APU FIRE EXT circuit breaker.

(6) Disconnect test lamp and reconnect leads to extinguisher cartridge unit.

(7) At DA/C remove trim panel, release stud fasteners and lower hinged panel. Connect a safety ohmmeter (maximum output 13mA) between the APU FIRE EXT circuit breaker terminal 2 and earth.

(8) Using safety ohmmeter, operate APU FIRE EXTinguisher switch and check circuit for resistance of 5 to 7 ohms. Release APU FIRE EXTinguisher switch and check for open circuit indication on safety ohmmeter. Disconnect safety ohmmeter.

(9) Ensure APU FIRE EXTinguisher switch is returned to normal position and hinged guard is in place.

(10) Refit and secure panel and electrical connections if affected.

(11) Reset APU FIRE EXT circuit breaker.

* * *

# DUAL HEAD FIRE EXTINGUISHER - MAINTENANCE PRACTICES

## 1. Removal/Installation

**NOTE** : The procedure for one extinguisher is given; the procedure for other extinguisher is similar.

Equipment required:

| | | |
|---|---|---|
| Cartridge shunt plug | .. | HTL PN 31001615 Supplied by Field Tech Ltd. England |
| Safety ohmmeter | .. | (Max. output current 13mA) |

### A. Remove fire extinguisher

**WARNINGS** : (1) HANDLE EXTINGUISHERS CAREFULLY, THEY ARE PRESSURE VESSELS THAT CONTAIN TOXIC LIQUID.

(2) TO AVOID INCORRECT RECONNECTION, MAKE CERTAIN LEADS TO EXTINGUISHER CARTRIDGES ARE CLEARLY IDENTIFIED BEFORE REMOVAL. FOR DETAILS OF ELECTRICAL WIRING TO FIRE EXTINGUISHERS, REFER TO FIGURE 201, TABLE 201 AND AIRCRAFT ELECTRICAL ROUTING CHART NO.25-F4-NA5/*22.

(1) On flight compartment panel DA/D, trip circuit breakers FIRE EXT No.1 (grid ref.B10) and FIRE EXT No.2 (grid ref.B11) (See Chapter 24, GENERAL).

(2) Disconnect electrical connector from both cartridge units and fit a shunt plug to each of the now open-ended units.

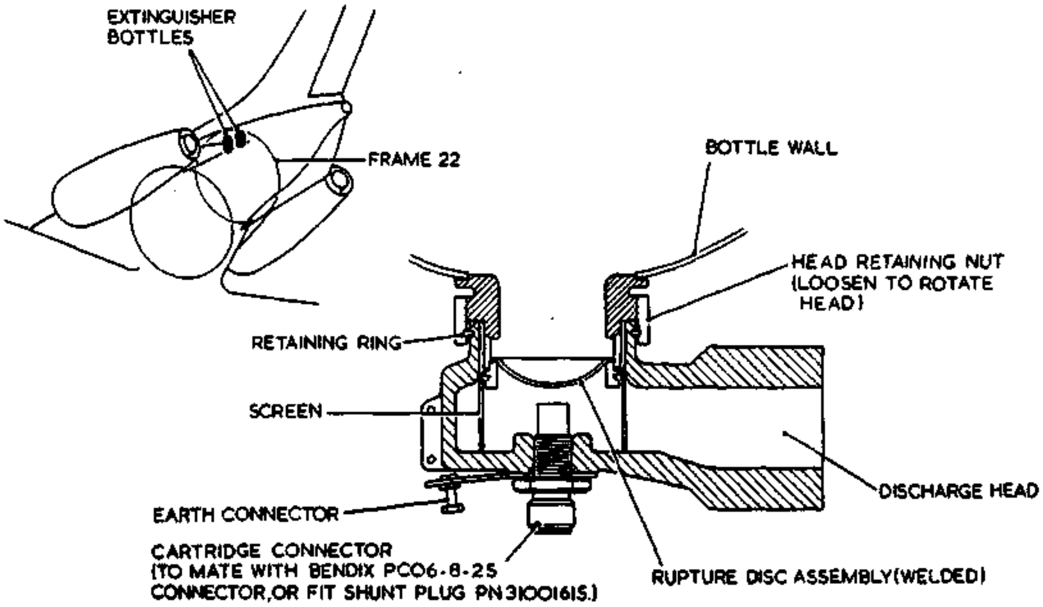
**WARNING** : DISPLACEMENT OR REMOVAL OF FILL FITTING OR RUPTURE DISC WILL RESULT IN POSSIBLE SERIOUS INJURY TO PERSONNEL IN VICINITY OF GAS BLAST OR TRAJECTORY OF EJECTED PARTS. DO NOT REMOVE FILL FITTING.

(3) Disconnect discharge pipes from both outlet banjo unions and also disconnect the indicator discharge pipe from the fill connection.

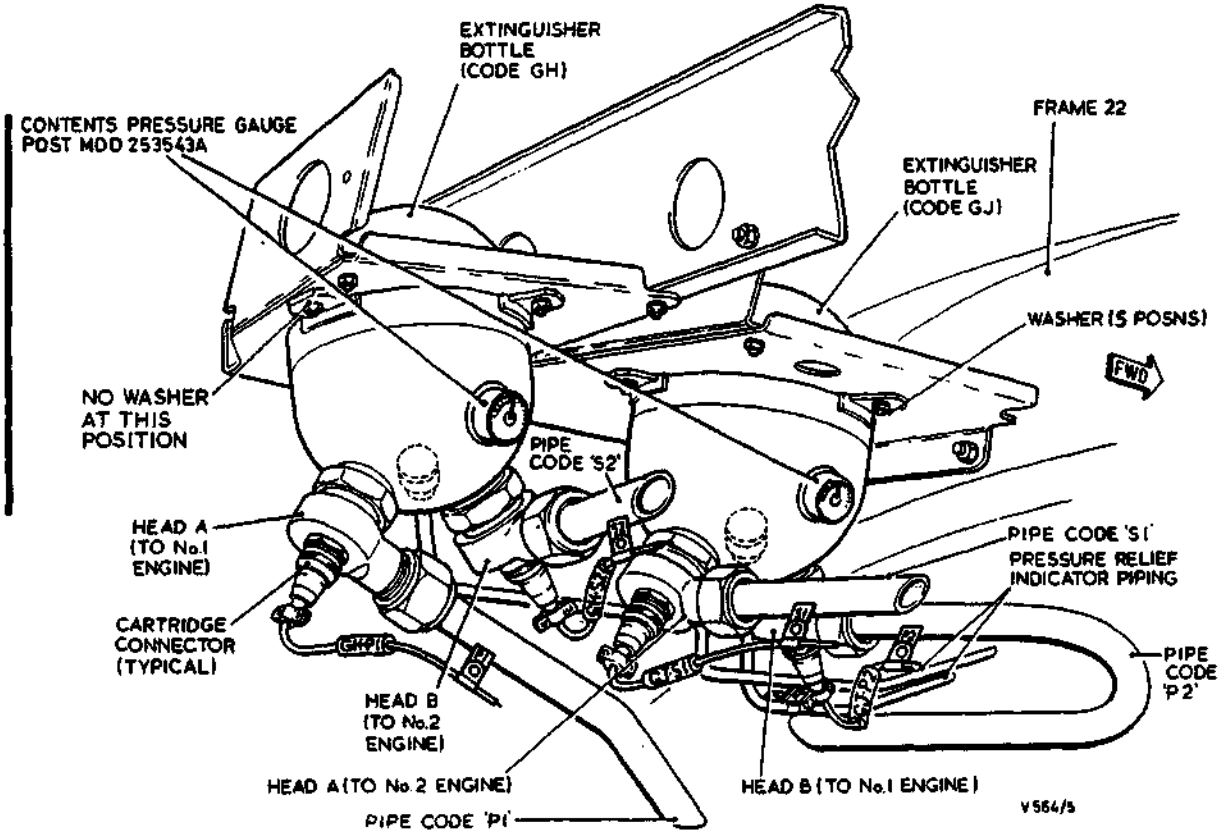
(4) Unscrew bolts securing bottle mounting lugs to mounting structure. Manoeuvre extinguisher to clear pipes and fittings and lift clear of mountings.

(5) Remove cartridge units (see Chapter 26, CARTRIDGE UNIT).

(6) Suitably blank-off all disconnected discharge pipelines and extinguisher banjo and indicator unions.


EXTINGUISHER BOTTLES
FRAME 22
BOTTLE WALL
HEAD RETAINING NUT (LOOSEN TO ROTATE HEAD)
RETAINING RING
SCREEN
DISCHARGE HEAD
EARTH CONNECTOR
CARTRIDGE CONNECTOR (TO MATE WITH BENDIX PC06-8-25 CONNECTOR,OR FIT SHUNT PLUG PN3100161S.)
RUPTURE DISC ASSEMBLY(WELDED)

TYPICAL SECTION THROUGH OPERATING HEAD


EXTINGUISHER BOTTLE (CODE GH)
CONTENTS PRESSURE GAUGE POST MOD 253543A
FRAME 22
EXTINGUISHER BOTTLE (CODE GJ)
WASHER (5 POSNS)
FWD
NO WASHER AT THIS POSITION
PIPE CODE 'S2'
HEAD A (TO No.1 ENGINE)
PIPE CODE 'S1'
PRESSURE RELIEF INDICATOR PIPING
CARTRIDGE CONNECTOR (TYPICAL)
PIPE CODE 'P2'
HEAD B (TO No.2 ENGINE)
HEAD A (TO No.2 ENGINE)
HEAD B (TO No.1 ENGINE)
PIPE CODE 'P1'
V564/5

Dual-head fire extinguisher
Fig.201

### B. Install fire extinguisher

(1) Ensure d.c. busbars are de-energized and at panel DA/D trip circuit breakers FIRE EXT No.1 (grid ref.B10) and FIRE EXT No.2 (grid ref.B11) (see Chapter 24, GENERAL).

(2) Fit cartridge units (see Chapter 26, CARTRIDGE UNIT).

(3) Before fire extinguishers are installed, check they are fully charged (Ref.Para.2.A.Inspection/Check).

CAUTION: DO NOT USE CARTRIDGE CONNECTOR ENDS TO LIFT THE EXTINGUISHER.

(4) Bolt extinguisher to its three-hole mounting structure in the rear equipment bay (see Fig.201).

(5) Remove blanks and connect all discharge pipelines to the extinguisher. If re-alignment of a banjo union is necessary, loosen the head retaining nut, reposition the banjo and torque tighten the union nut 40-50 ft.lb. (54.23 - 67.79 Nm) and wirelock. Wirelock all discharge pipe unions.

(6) Remove the shunt plugs and install the electrical supply connectors. For details of electrical wiring to fire extinguishers, see Fig.201 and Table 201. Secure connectors using 0.8mm stainless steel corrosion resistant locking wire.

| EXTINGUISHER BOTTLE | PIPE CODE | ELECTRICAL CONNECTOR CODE |
|---|---|---|
| GH HEAD 'A' | P1 | GH-P1 |
| GH HEAD 'B' | S2 | GH-S2 |
| GJ HEAD 'A' | S1 | GJ-S1 |
| GJ HEAD 'B' | P2 | GJ-P2 |

Table 201

NOTE: For position of pipes and electrical connector codes refer to Fig.201.

(7) Connect a safety ohmmeter (maximum output 13 mA) between terminal 2 of the relevant aircraft circuit breaker and earth.

(8) Refer to Aircraft Electrical Routing 25-F4-NA5/*22 and Table 202, operate relevant fire extinguisher switch and check that safety ohmmeter reading is between 1.5 and 2.0 ohm for each switch selection. Disconnect safety ohmmeter.

| ENG.FIRE EXT | HEAD | FIRE EXT.SWITCH | SWITCH POSITION |
|---|---|---|---|
| 'GH' | 'A' | ENG. 1 EXT. | SHOT 1 |
| 'GJ' | 'B' | ENG. 1 EXT. | SHOT 2 |
| 'GJ' | 'A' | ENG. 2 EXT | SHOT 1 |
| 'GH' | 'B' | ENG. 2 EXT. | SHOT 2 |

Table 202

(9) Ensure extinguisher operating switches on the roof panel are in the centre-off position.

(10) Reset circuit breakers (see para.1.A.(1)).

## 2. Inspection/Check

### A. Check-weigh extinguisher

(1) Check for leakage by ensuring that the weight of the extinguisher is within ± 0.10 lb. (± 0.04 kg.) of the figure marked on the unit identification plate.

NOTE: For check-weighing purposes, the assembled extinguisher must consist of the charged container with discharge banjo outlets, screens, cartridges and fill fitting assembly. All protective caps and shunt plugs must be removed.

### B. Visually check extinguisher contents (Mod.253543A)

(1) Examine the contents pressure gauge on the extinguisher. At an ambient temperature of 70°F make sure the indicator is in the green band on the gauge. Refer to the temperature/pressure data plate for temperatures other than 70°F. If the indicator is in the red band, reject the extinguisher.

## CARTRIDGE UNIT - MAINTENANCE PRACTICES

### 1. Removal/Installation

WARNING: EACH CARTRIDGE IS AN EXPLOSIVE DEVICE. INADVERTENT DETONATION OF A CARTRIDGE CAN CAUSE PERSONAL INJURY. FOR SAFE HANDLING, THE ELECTRICAL CONNECTION PINS MUST BE SHORTED TO THE BODY. THE SHORTING DEVICE (SHUNT PLUG) MUST BE REMOVED BEFORE TESTING CARTRIDGE OR ASSEMBLING THE MATING CONNECTOR.

CAUTION: DO NOT USE CARTRIDGE CONNECTOR END TO LIFT DISCHARGE OUTLET OR EXTINGUISHER.

#### A. Remove cartridge unit

(1) Remove extinguisher from aircraft (see Chapter 26, DUAL-HEAD FIRE EXTINGUISHER).

(2) With shunt plug fitted, unscrew cartridge unit from discharge banjo union and place unit in a polythene envelope and seal envelope.

NOTE: Discard cartridge units which have been fired.

#### B. Install cartridge unit

With shunt plug fitted, screw cartridge unit in position in discharge banjo union. Wirelock cartridge unit hexagon.

### 2. Adjustment/Test

NOTE: Conduct the following test with cartridge unit removed from extinguisher. As an additional safeguard, the unit should be mounted on a suitable fixture with the charge end shielded but un-restricted in case of inadvertent firing.

#### A. Test fuse resistance

(1) Using a safety ohmmeter (13 mA maximum), check the fuse resistance between the pole pins. The resistance value should be 1.0 ± 0.1 ohm.

* * *

# PRESSURE RELIEF DISCHARGE INDICATOR - MAINTENANCE PRACTICES

## 1. Servicing

### A. Renew disc and plug

(1) Drill a small hole in centre of disc and pull disc clear of indicator. Do not lever around bowl rim.

(2) Disconnect indicator pipe and eject sealing plug. Refit pipe.

(3) Press a new plug into the dome orifice.

(4) Fit a new disc by pressing it into the groove around bowl rim.

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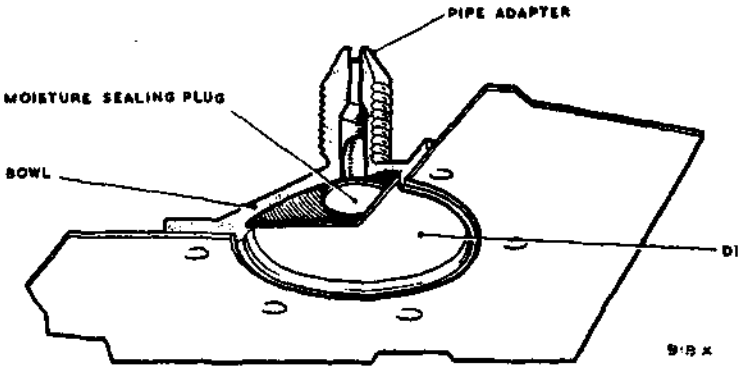

Pressure relief discharge indicator
Fig.201

* * *

# EXTINGUISHER FIRED INDICATOR - MAINTENANCE PRACTICES

## 1. Unit servicing

### A. Remove fuse

(1) Unscrew and remove cover and withdraw fuse from holder.

### B. Install fuse

(1) Insert fuse into holder and refit cover.

## 2. Removal/Installation

### A. Remove indicator

(1) On panel DA/D trip circuit breakers FIRE EXT No.1 (grid ref.B10) and FIRE EXT No.2 (grid ref.B11) (see Chapter 24, GENERAL).

(2) Remove screws securing Ext. 1 or 2 Fired indicator to panel and withdraw indicator from back of panel.

(3) Disconnect electrical cables at indicator.

### B. Install indicator

(1) Connect electrical cables to indicator.

(2) Secure indicator to panel.

(3) Reset fire extinguishing circuit breakers (para. 2.A. (1)).

## 3. Adjustment/Test

### A. Test continuity of indicator fuse

(1) Detach the electrical cables from the extinguisher fired indicator and using a safety ohmmeter check the continuity of the indicator. The test current must not be in excess of 13 mA, and the resistance value must be between 31 and 39 ohms.

* * *

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## APU FIRE EXTINGUISHER - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove APU fire extinguisher

WARNING : HANDLE EXTINGUISHER CAREFULLY, IT IS A PRESSURE VESSEL THAT MAY CONTAIN TOXIC LIQUID.

(1) On panel DA/C trip circuit breaker APU FIRE EXT (grid ref.H1) (see Chapter 24, GENERAL).

(2) Disconnect electrical leads from cartridge unit.

(3) Disconnect pressure relief and extinguishant piping, and fit blanking caps.

(4) Remove extinguisher.

(5) WARNING : THIS UNIT CONTAINS GUNPOWDER - HANDLE WITH CARE.

Remove cartridge unit from bottle (see Para.1.C.).

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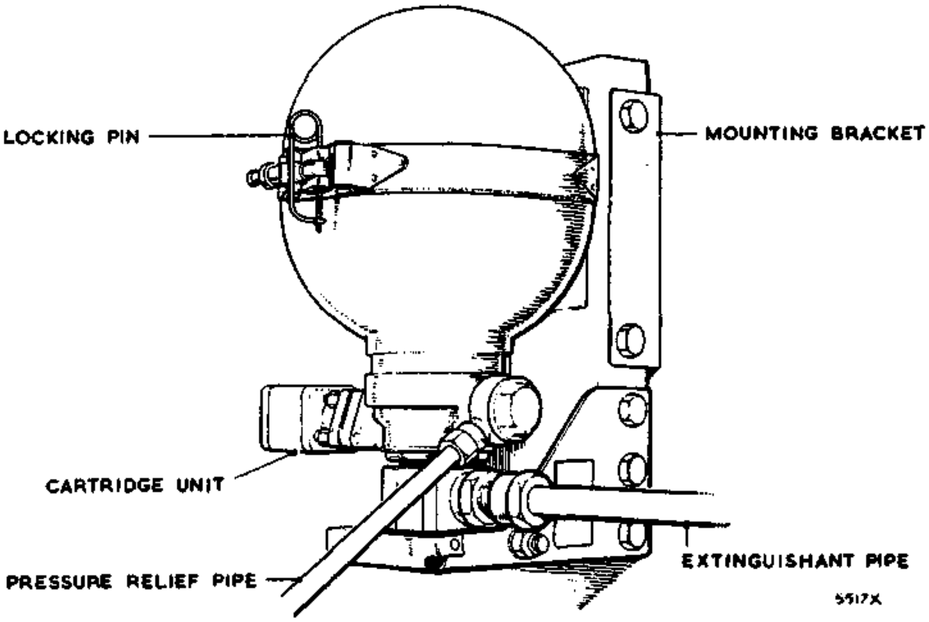

APU fire extinguisher
Fig.201

B. Install APU fire extinguisher

(1) Check-weigh the extinguisher (see para.3).

(2) Remove transit caps from extinguisher, fit and lock cartridge unit (see para.1.D.).

(3) Position and secure extinguisher with strap. Insert special locking pin.

(4) Slacken locknut and position junction to suit connection with extinguishant pipe; do not unscrew junction more than one complete turn. Tighten locknut and wire-lock.

(5) Connect extinguishant piping, tighten union and wire-lock.

(6) Adjust pressure relief banjo coupling to required position, torque tighten banjo bolt to 15-20 lb.ft. and wire-lock. Fit pressure relief piping, tighten union and wire-lock.

(7) Reset circuit breaker (para. 1.A. (1)) and functionally test APU fire extinguisher circuit (see Chapter 26, FIRE EXTINGUISHING).

C. Remove cartridge unit

WARNING : CARTRIDGES CONTAIN GUNPOWDER - HANDLE WITH CARE.

(1) Remove extinguisher from aircraft (see para. 1.A.).

(2) Remove nuts and locking plates securing cartridge units.

(3) Carefully withdraw cartridge unit, together with O-ring sealing washer, from extinguisher mounting studs.

(4) Fit a transport cap over the operating head, place the cartridge unit in a polythene envelope and seal the envelope.

NOTE : Discard cartridge units that have been fired.

D. Install cartridge unit

(1) Remove transport cap from cartridge unit, and check that O-ring sealing washer is in position and carefully assemble cartridge unit over the four mounting studs, aligning the locating pin with the hole in the cartridge unit mounting platform.

NOTE : Staggered pins on the cartridge unit prevent incorrect assembly to the bottle.

(2) Fit new locking plates over mounting studs; assemble nuts, tighten and lock them.

(3) Install extinguisher in aircraft (see Para.1.B.).

## 2. Adjustment/Test

NOTE: Conduct the following tests with cartridge unit removed from extinguisher. As an additional safeguard, the unit should be mounted on a suitable fixture with the charge end shielded, but unrestricted, in case of inadvertent firing.

### A. Test cartridge unit insulation resistance

(1) Using a 250-volt insulation resistance tester, check the insulation resistance between the cartridge poles and earth with the poles shorted together. The insulation resistance should not be less than 20 megohms.

### B. Test cartridge unit fuse resistance

(1) Using a safety ohmmeter (13mA max.) check the resistance of the fuse between poles. The resistance value should be between 5 and 6 ohms.

## 3. Inspection/Check

### A. Check-weigh extinguisher

WARNING: MAKE SURE THE ANTI-RECOIL CAPS ARE FITTED TO THE EXTINGUISHER OUTLET.

Check that the weight of the extinguisher (including anti-recoil cap but less cartridge unit) is within one ounce of the figure stamped on the operating head.

NOTE: An extinguisher whose stamped weight includes the anti-recoil cap has a letter "M" stamped in the serial number on the operating head. If the weight stamped on the head does not include anti-recoil caps, the caps must remain fitted and an allowance of 0.37 oz. (10.7 grammes) be made.

* * *

# CHAPTER

# 27

# FLIGHT CONTROLS

# CHAPTER 27

# FLIGHT CONTROLS

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# FLIGHT CONTROL - GENERAL DESCRIPTION

## 1. Primary controls

The primary control surfaces (elevators, ailerons and rudder) are manually operated from a conventional control column, handwheel and rudder pedals via a system of cables, connecting rods and pulleys. Each control surface is mass and aerodynamically balanced. Geared tabs providing servo action are installed to each aileron. An anti servo tab is installed to the rudder. Trim tabs are installed to the elevators, left aileron and rudder. When the associated trim controls are at neutral, the aileron and elevator trim tabs provide a servo action, the rudder tab provides anti servo action. Trim tab controls are mounted on the control pedestal.

A control column and rudder pedals are installed on the left and right side of the flight compartment. A stick shaker unit, associated with the stall warning system is installed to the left column (Chapter 34, NAVIGATION - STALL WARNING SYSTEM). Rudder pedals are adjustable for reach. A pneumatic rudder bias system provides automatic compensation for asymmetric thrust. This facility can be manually isolated by electrically controlled solenoid valves.

## 2. Secondary controls

The secondary controls (flaps and airbrakes) are hydraulically operated and controlled from levers on the control pedestal. Main hydraulic system power is used to operate the flap and airbrake systems (Chapter 29, HYDRAULIC - MAIN SYSTEM). In an emergency, the flap system can be operated by auxiliary system power. When the flaps are in the landing position, an interconnection between the flap and airbrake system permits the airbrakes selector to be used for lowering the flaps further to a lift dump position in addition to opening the airbrakes.

## 3. Control cables

Control cables are routed from the controls to the control surface via pulleys and fairleads. Cable ends and intermediate connections are arranged so as to prevent a control system being crossed. Plastic markers, on each cable end, carry a code to assist identification during maintenance. Fairleads protect cables passing through structure. Those in the fuselage, under the passenger compartment center walkway are engraved with the cable code numbers of the cables accommodated by that fairlead. A pressure seal is installed around each cable where it passes out of the pressurized portion of the fuselage.

*NOTE: For examination and rejection criteria of the control cables (Chapter 20, STANDARD PRACTICES - CONTROL CABLE - EXAMINATION AND REJECTION CRITERIA).*

# FLIGHT CONTROL - MAINTENANCE PRACTICES

## 1. Flying control cables

### A. Control cable tensioning - General

(1) For correct rigging of the flying control cables, the airplane must be standing on the nose and main landing gear with fuel tanks empty. If the airplane has been flown at high altitude and/or low temperature for a prolonged period, it is advisable to allow the airplane to stand for approximately six hours to stabilize the structure temperature.

(2) The following control system cable tensions are correct for an ambient temperature of +70°F (21.1°C):

| | | |
|---|---|---|
| Aileron control system | 70 to 80 lb | ) (AILERON AND AILERON TRIM |
| Aileron trim control system | 25 to 30 lb | ) CONTROL SYSTEMS) |
| Aileron servomotor circuit | 95 to 100 lb. | (AILERON SERVO MOUNT) |
| Rudder control system | 70 to 80 lb | ) (RUDDER AND RUDDER TRIM |
| Rudder trim control system | 25 to 30 lb | ) CONTROL SYSTEMS) |
| Rudder servomotor circuit | 95 to 100 lb. | (RUDDER SERVO MOUNTING) |
| Elevator control system - forward | 70 to 80 lb | )<br>) |
| Elevator control system - aft of elliptical pulley | 90 lb ±5 lb | ) (ELEVATOR AND ELEVATOR TRIM<br>) CONTROL SYSTEMS) |
| Elevator trim control system | 25 to 30 lb | ) |
| Elevator servomotor circuit | 95 to 100 lb. | (ELEVATOR SERVO MOUNTING) |
| Flap control system | 35 to 40 lb. | (FLAP CONTROL SYSTEM) |
| Airbrake control system | 35 to 40 lb. | (AIRBRAKE AND LIFT DUMP CONTROL SYSTEM) |

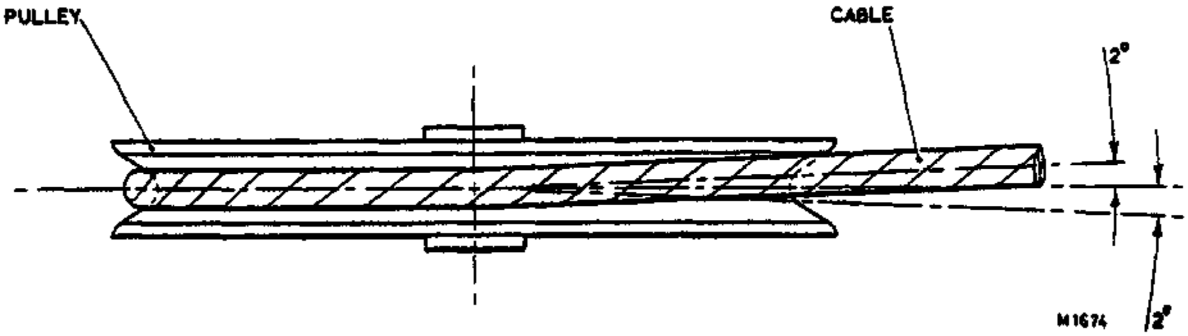
(3) If there is any deviation from the above mentioned temperature, the tensions quoted above should be decreased for a fall in temperature, or increased for a rise in temperature by the amounts that follow:

| | |
|---|---|
| Aileron control system | 5 lb/5°F (2.8°C) |
| Aileron trim system | 1 lb/5°F (2.8°C) |
| Rudder control system | 3 lb/5°F (2.8°C) |
| Rudder trim system | 1 lb/5°F (2.8°C) |
| Elevator control system | 5 lb/5°F (2.8°C) |
| Elevator trim system | 1 lb/5°F (2.8°C) |
| Airbrake control system | 2 lb/5°F (2.8°C) |
| Flap control system | Nil |

(4) Complete rigging procedures, and location of cables and turnbuckles are given in the relevant control system or subject Maintenance Practices.

### B. Control cable alignment (*Figure 201*)

(1) The maximum permitted misalignment between the control cable and pulley in any primary control system is 2 degrees.



Permitted misalignment
*Figure 201*

### C. Control cable clearance

Visually check the cables, including turnbuckles, for a working clearance taking into consideration:

- How taut the cable run is, or may become.
- The distance from a supporting pulley or fairlead.
- The amount of cable movement likely to occur, lengthwise, lateral or vertical.

Confirm clearances during the functional check of the relevant control system. If any doubt exists contact the Raytheon Aircraft Company.

## 2. Hoffman bearings with removable seals

### A. Lubrication of fitted bearings *(Figure 202)*

| Equipment/Materials | Part/Item No. |
|---|---|
| Cleaning fluid | 230 (Chapter 20-95-101) |
| Grease, low temperature | 078 (Chapter 20-95-11) |

*NOTE: It is important that seals are fitted on the same side and in the same attitude, therefore it is necessary to note their location before removal.*

(1) Make a temporary mark on each side of the bearing housing and seal to record location for assembly.

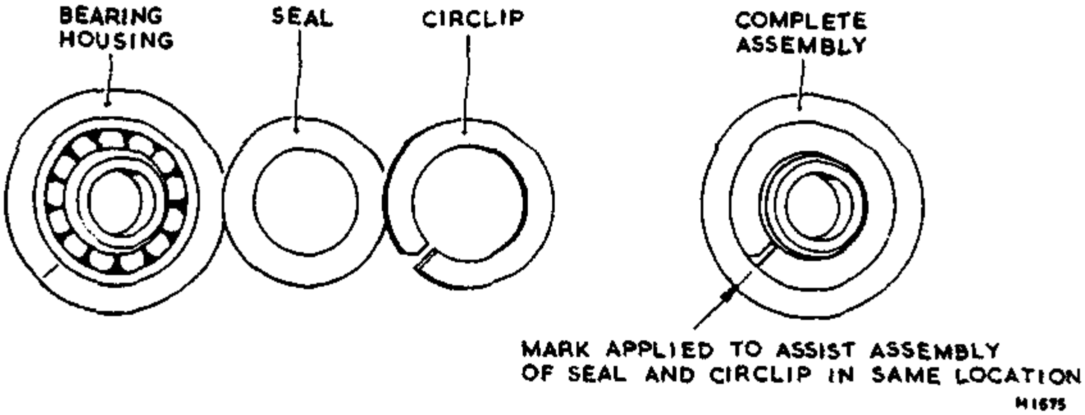
(2) Carefully remove the circlip from each groove and lift out both seals.

(3) Thoroughly wash the bearing in cleaning fluid. Blow out with dry compressed air, make sure that the bearing is not spun.

(4) When bearing is dry, examine for corrosion, excessive wear, broken or missing balls and cage damage.

(5) Immediately the examination is completed, make sure that the bearing is greased to a minimum 80% capacity.

(6) Carefully install the seals and circlips (refer to NOTE), make sure that the circlips are firmly seated in their groove.

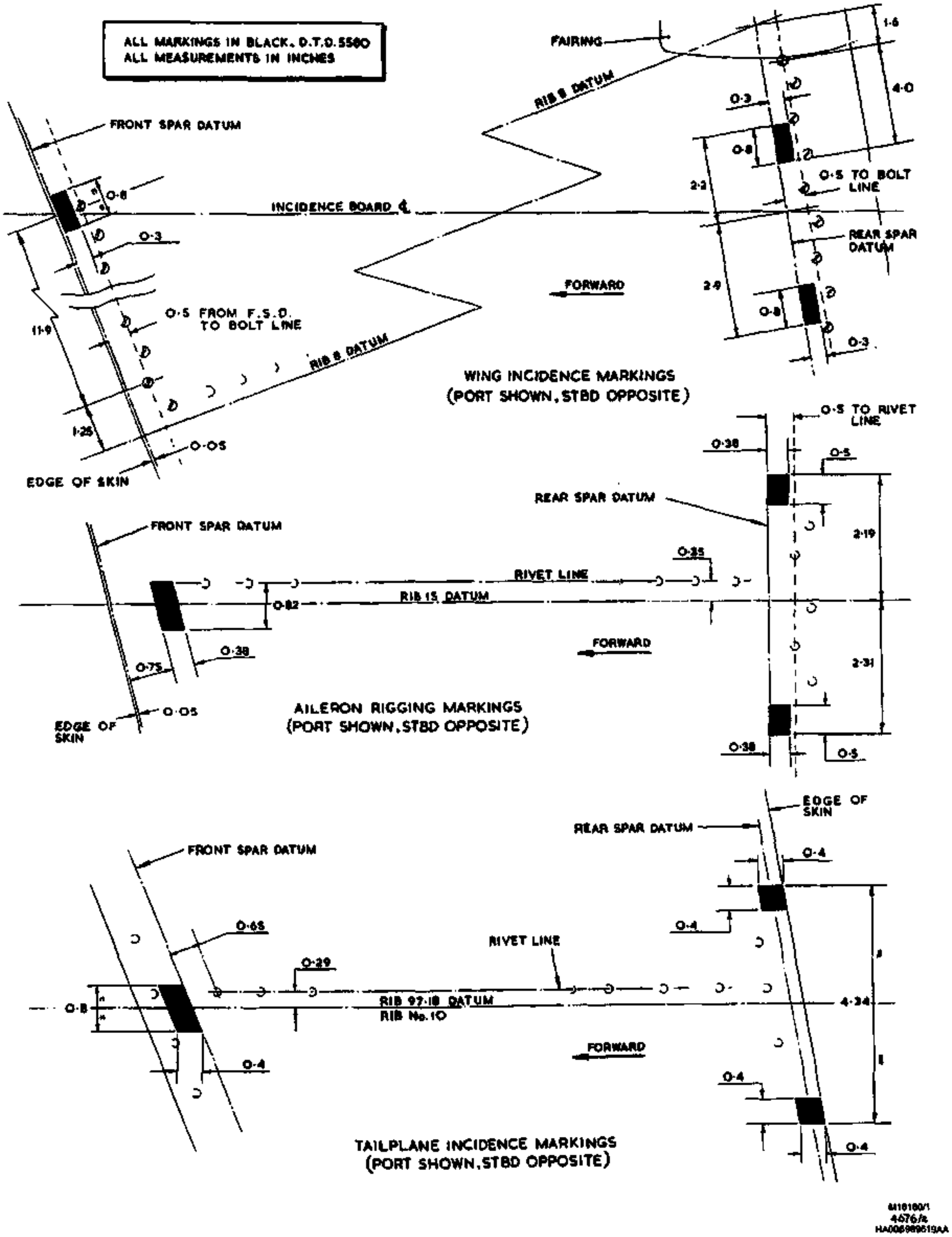

BEARING HOUSING
SEAL
CIRCLIP
COMPLETE ASSEMBLY
MARK APPLIED TO ASSIST ASSEMBLY OF SEAL AND CIRCLIP IN SAME LOCATION
H1675

Hoffman bearing with removable seals
*Figure 202*

## 3. Rigging markings

### A. Wing and tailplane (horizontal stabilizer)

(1) Details of the location of rigging markings on the wing and tailplane are shown on *Figure 203.*



Rigging markings
*Figure 203*

# AILERON AND AILERON TRIM CONTROL SYSTEMS - DESCRIPTION AND OPERATION

## 1. Aileron control system *(Figure 1)*

### A. General

Movement of the control column handwheel is transmitted via chains and cables to a lever at the bottom of the column. Elliptical sprockets within the column give a progressive increase in aileron movement as the handwheel is rotated away from neutral. A connecting rod links the left column lever to a pulley drum under the flight compartment floor. When two control columns are fitted, a further connecting rod links the left column lever to the right column lever. Both these connecting rods incorporate a swivel, which allows rotation of one eye end about the rod longitudinal axis; this arrangement caters for the rotational movement developed in the control column to pulley drum connecting rod and, in the case of the left and right control column connecting rod, permits the right hand column to be stowed forward.

From the pulley drum under the flight compartment floor, independent circuits of cables are directed rearward to the wing rear spar and then outboard to pulley drums interconnected to the ailerons. The latter pulley drums have an integral lever incorporating a needle bearing. Rotary movement of the integral levers is transmitted to 'A' levers by the needle bearings. The 'A' levers operate the ailerons through input connecting links which pivot on the inboard hinge bracket.

Both ailerons have two servo-action geared tab; each tab is operated by two connecting rods, the forward ends of which are secured to a lever in the aileron center hinge.

### B. Aileron stops

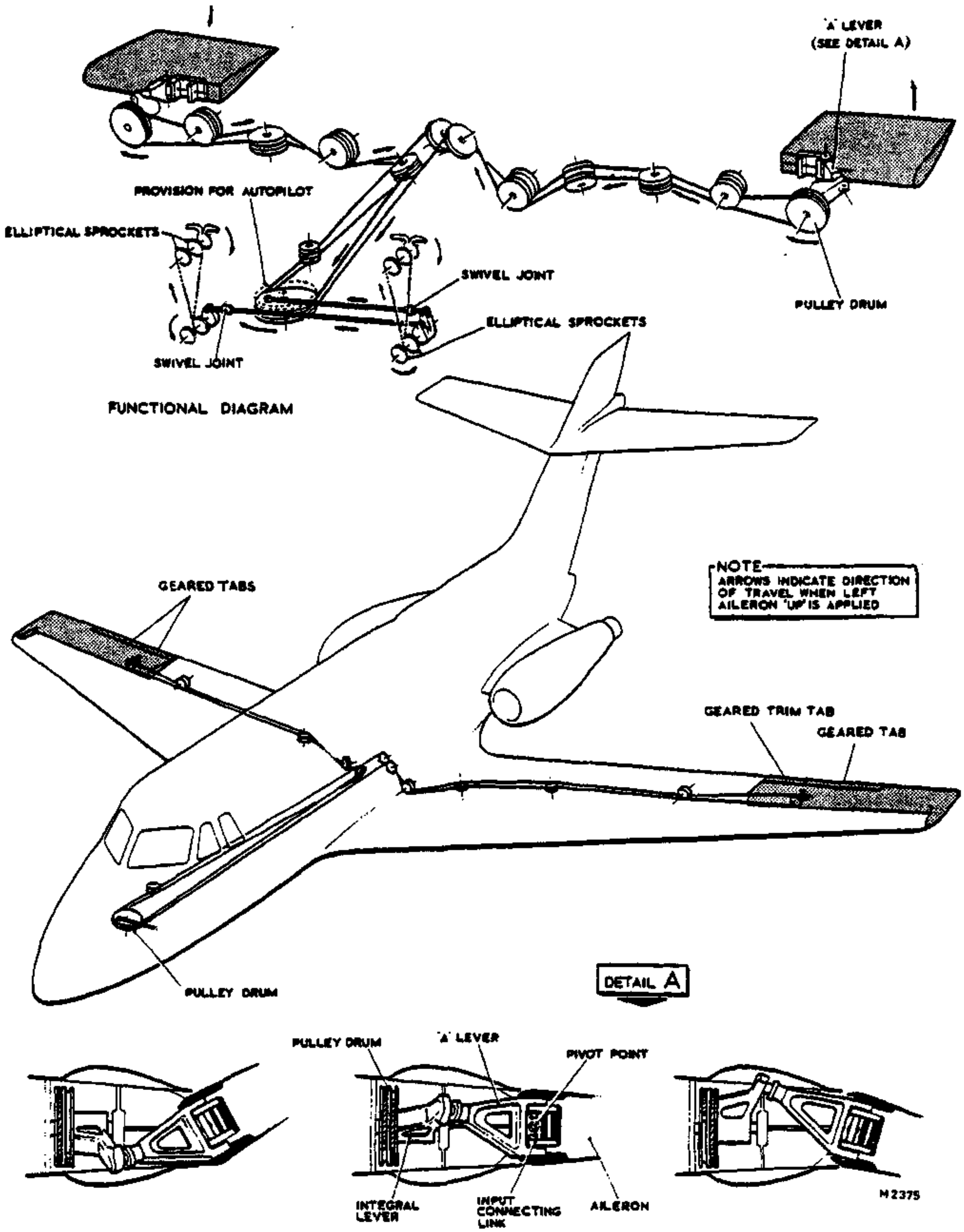
Primary stops are located at the left and right aileron inboard hinge. A shim adjusted stop bolt in each hinge bracket contacts the input connecting link, and determines the range of movement. The primary stops limit the upward movement of the associated aileron; downward movement of either aileron is limited when the up stop of the opposite aileron takes effect.

Secondary stops are located at the bottom of each control column. When either primary stop takes effect, a clearance exists at the secondary stop.

## 2. Aileron trim control system *(Figure 3)*

### A. General

A trim tab on the left aileron is controlled from a trim box in the control pedestal. Cables and chains connect a cable drum in the trim box to a sprocket mounted on the wing rear spar. A torque shaft connects the sprocket to a trim jack. The trim jack is a non-reversible screw type, with twin output fork-ends operated by a common drive. Two connecting rods pass through the aileron, to link the trim jack to the tab. The relationship of the trim jack to the aileron hinge line is such that any selected trim tab position will remain constant in relation to aileron chord, regardless of aileron movement.



Aileron control system

*Figure 1*

### B. Trim box

An aileron trim handwheel and a cable drum are splined onto a shaft which rotates in the trim box; a scroll plate is pinned to the shaft. Five tumblers are free to rotate about the shaft; each tumbler embodies a stop face which contacts the stop face of the adjacent tumbler. The first and fith tumbler stop faces also contact a stop bracket and a dog on the scroll plate. The tumblers allow 4.6 handwheel revolutions.

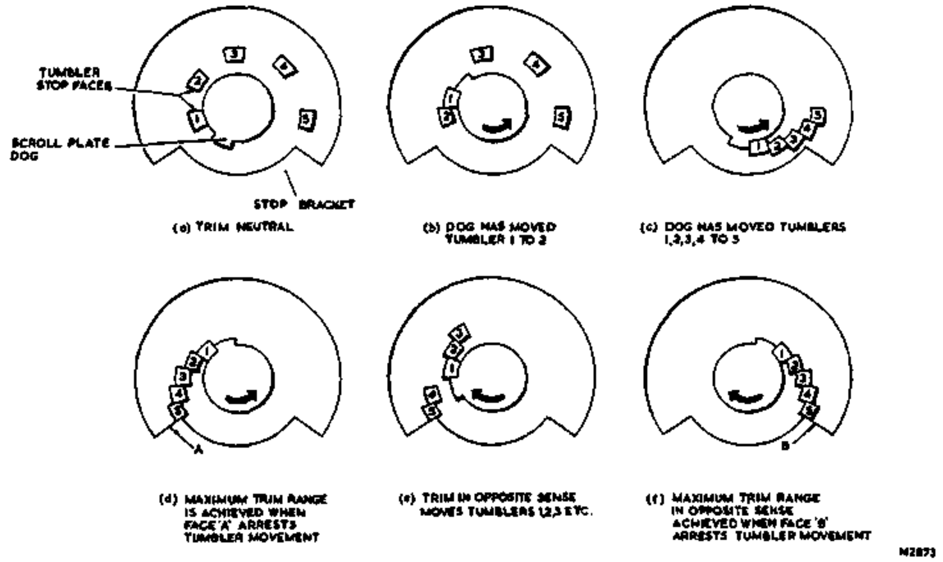
The scroll plate is helically grooved on its aft face; a pointer, fitted with a pin which locates in this groove, indicates trim position on a label (graduated scale).

### C. Operation *(Figure 2)*

Rotation of the aileron trim handwheel turns the scroll plate, and the dog on the scroll plate contacts the stop face of the adjacent tumbler. Each successive revolution engages another tumbler. The schematic operation on (a) to (d) shows tumbler movement in one trim sense. Trim movement in the opposite sense (e) and (f) moves the scroll plate so that the opposite face of the dog contacts the other stop face of tumbler No.1.

### D. Aileron trim stops

The range of movement of the trim tab is limited solely by the stop faces of the tumblers in the trim box. There is no adjustment to the trim tab range of movement.



(a) TRIM NEUTRAL

(b) DOG HAS MOVED TUMBLER 1 TO 2

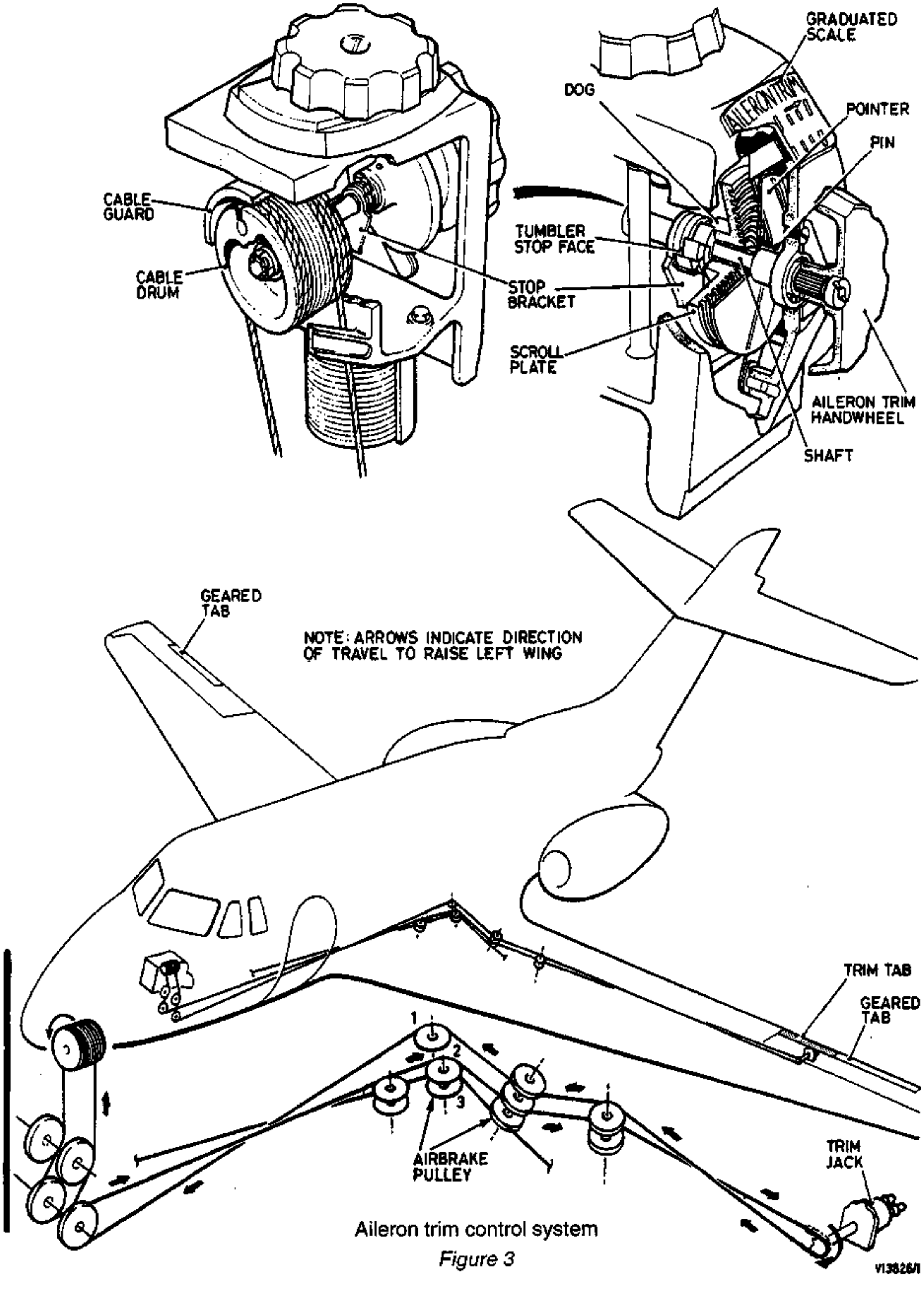
(c) DOG HAS MOVED TUMBLERS 1,2,3,4 TO 5

(d) MAXIMUM TRIM RANGE IS ACHIEVED WHEN FACE 'A' ARRESTS TUMBLER MOVEMENT

(e) TRIM IN OPPOSITE SENSE MOVES TUMBLERS 1,2,3 ETC.

(f) MAXIMUM TRIM RANGE IN OPPOSITE SENSE ACHIEVED WHEN FACE 'B' ARRESTS TUMBLER MOVEMENT

Schematic operation of trim stops
*Figure 2*



Aileron trim control system

*Figure 3*

# AILERON AND AILERON TRIM CONTROL SYSTEMS - ADJUSTMENT/TEST

## DUPLICATE INSPECTION

**WARNING: WHENEVER ANY PART OF THIS SYSTEM IS DISMANTLED, ADJUSTED, REPAIRED OR RENEWED, DETAILED INVESTIGATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT DISTORTION, TOOLS, RAG OR ANY OTHER LOOSE ARTICLES OR FOREIGN MATTER SUCH AS COULD IMPEDE THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM ARE NOT PRESENT, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE WORK AREA ARE CLEAN.**

**WARNING: WHENEVER ANY PART OF EITHER THE MAIN OR ANY ASSOCIATED SYSTEM IS DISMANTLED, ADJUSTED, REPAIRED OR RENEWED, THAT PART OF THE SYSTEM WHICH HAS BEEN DISTURBED SHALL BE SUBJECTED TO A DUPLICATE INSPECTION FOR SECURITY OF LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

## 1. Unit servicing

### A. Lubrication

(1) For routine lubrication data refer to the Maintenance Schedule.

(2) For the procedure to lubricate the aileron control cables at the fuselage pressure seals refer to AMM 12-20-25.

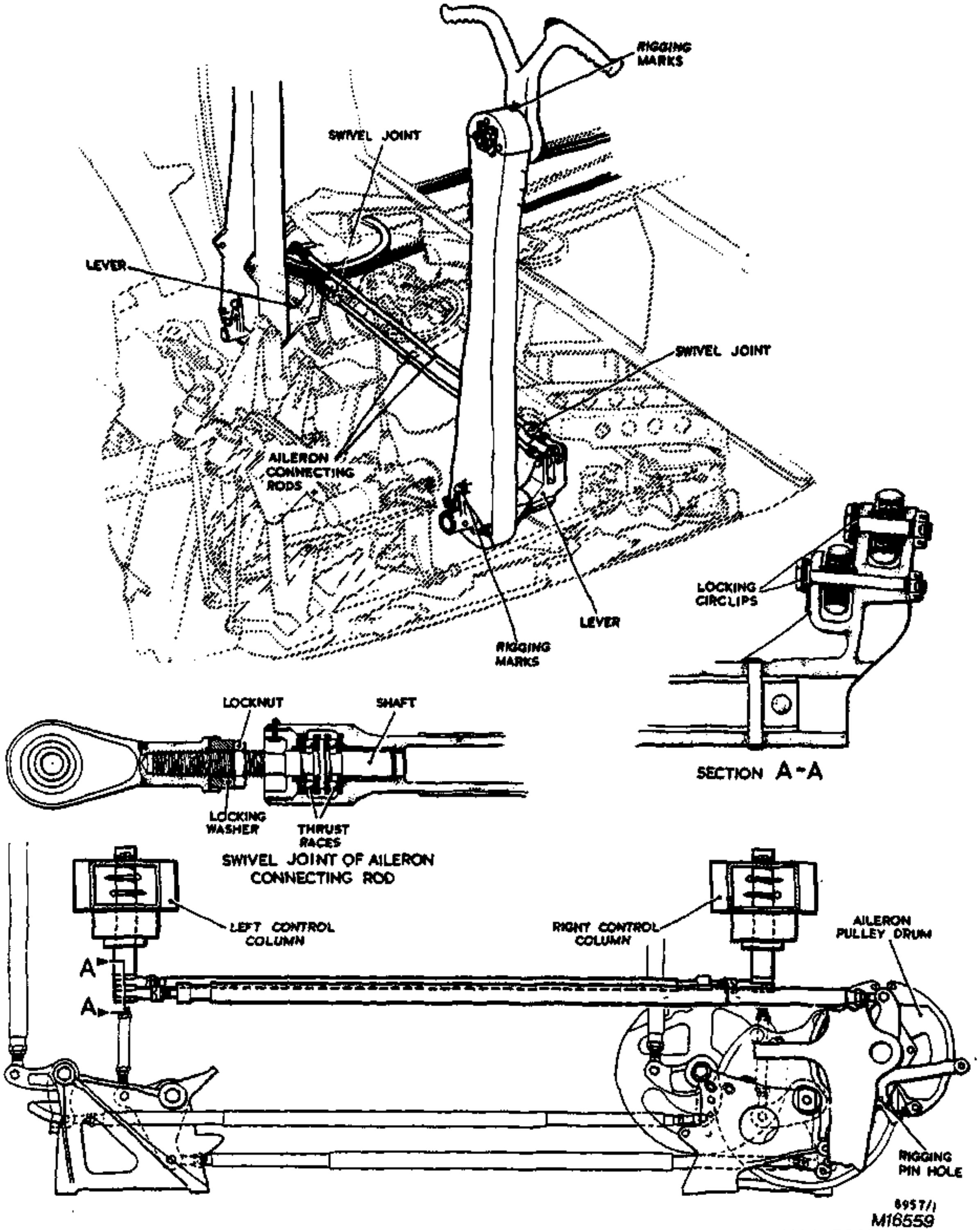
## 2. Adjustment/Test

| Equipment/Material | Part/Item No. |
|---|---|
| Rigging pins | 25Y493A |
| Rigging plate | 25Y283A/B (Pre. Mod. 255319) |
| Rigging plate | 25Y801A (Mod. 255319) |
| Tensiometer | Teleflex T5/2002/401/00 |
| Inclinometer | – |
| Grease, low temperature | 078 (Chapter 20-95-11) |

### A. Rig aileron control system *(Figure 501)*

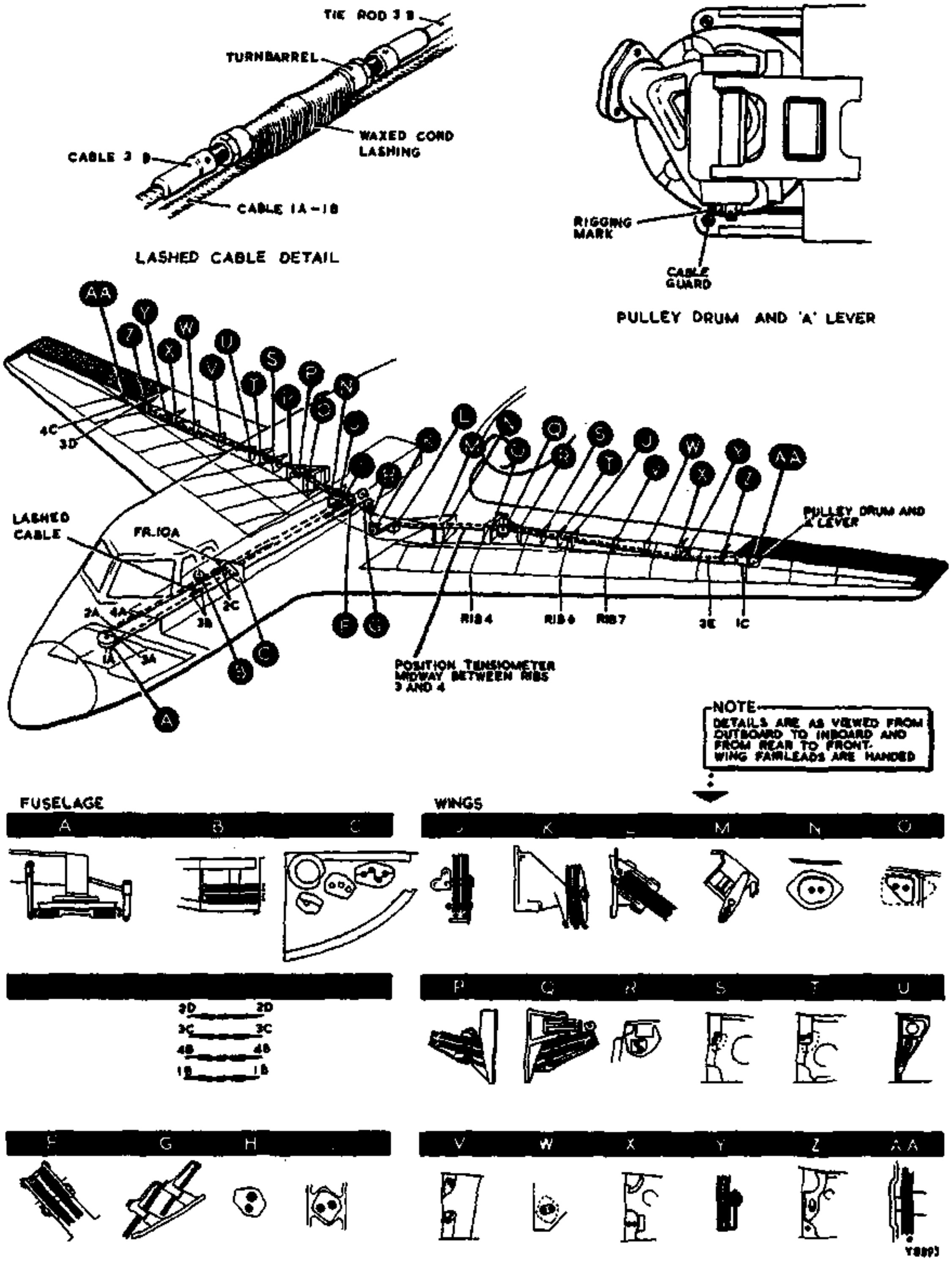
**Rig aileron control system forward of pulley drum**

(1) Check control column rigging (Chapter 27, CONTROL COLUMN - MAINTENANCE PRACTICES).



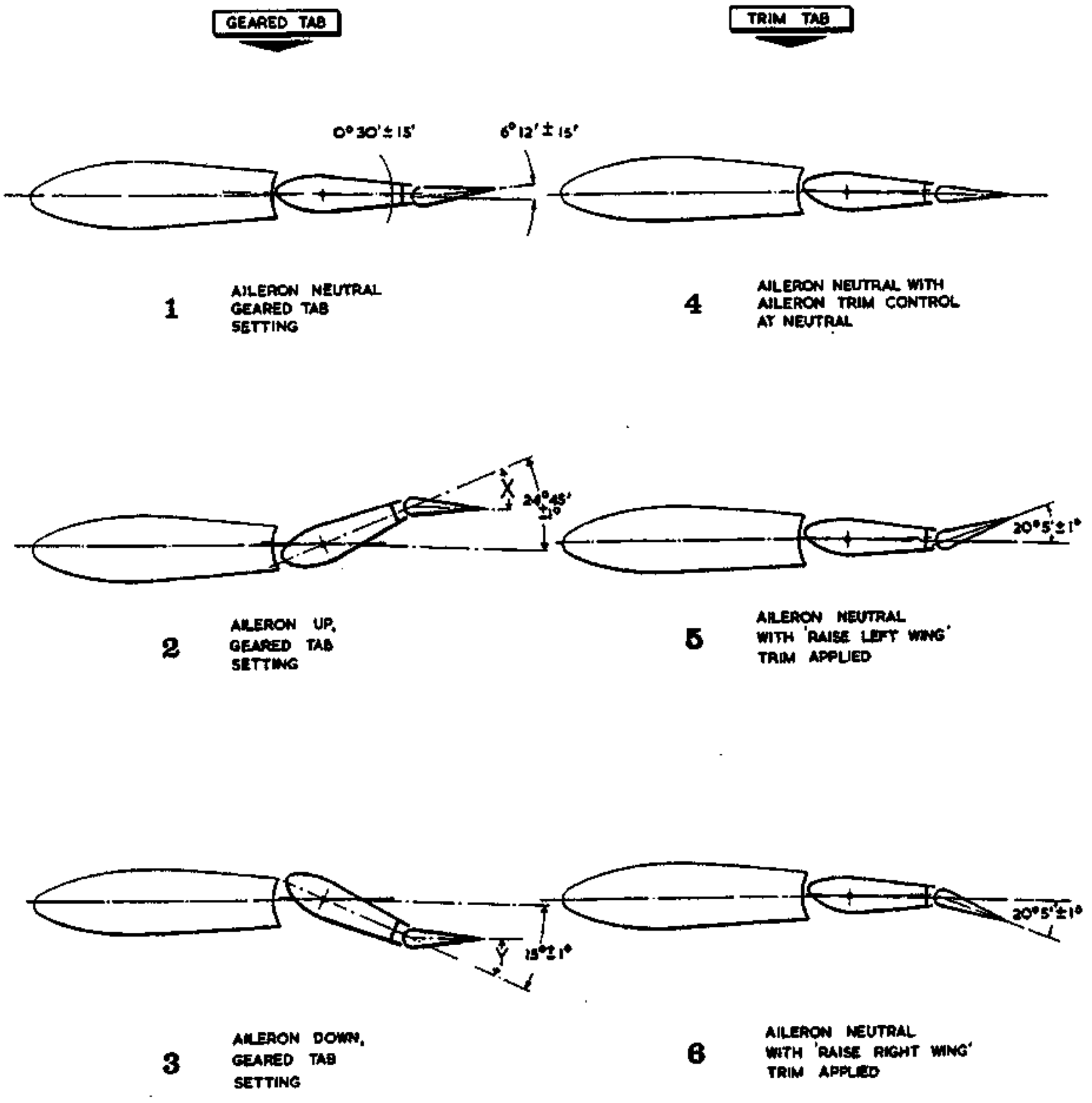
Aileron controls in forward fuselage

*Figure 501*



Aileron control system rigging

*Figure 502*



*Notes*

ANGLES MEASURED RELATIVE TO HINGE LINE.

AILERON NEUTRAL SHOWN ABOVE IS AUTOMATICALLY ACHIEVED BY USE OF RIGGING PLATE.

V1366/2

Aileron and aileron tabs - movements

*Figure 503*

(2) Insert rigging pin through rigging pin holes in aileron pulley drum and its mounting and check the rigging marks at the bottom of the left column are aligned. If necessary, adjust the aileron connecting rod between the left column and the aileron pulley drum to align the rigging marks. Check that rod end is in safety, tighten locknuts, and wire-lock. Check that the rigging marks at the bottom of the right control column are aligned. If necessary, adjust the aileron connecting rod between left and right control column to align the rigging marks. Check rod ends are in safety, tighten locknuts and wire-lock.

NOTE: *To adjust aileron connecting rods at swivel joint, slacken lock nuts, disengage locking washer from eye end, and rotate threaded shaft. Locate locking washer in slots in eye end before tightening locknut.*

**Rig aileron control system aft of pulley drum** *(Figure 502)*

(3) Assemble rigging plate with face engraved TOP LEFT uppermost, and position rigging plate on black painted marks on left wing.

(4) Align left aileron trailing edge with neutral mark of rigging plate. Set tensiometer to suit 15 cwt. or 25 cwt. cables as appropriate; position tensiometer on aileron cables, midway between ribs 3 and 4 of the left wing. Adjust turnbuckles connecting cable and tie-rod ends 1B-1B, 2C-2C, and 2D-2D to achieve cable tension of 70-80 lb, maintaining trailing edge alignment.

NOTE: *For access to turnbuckles concealed in conduit between frames 11 and 12, temporarily remove rigging pin, and operate control column handwheel.*

NOTE: *If the aileron is not installed, paragraph (4) can be partially completed at this stage by aligning the cable drum rigging mark with the bottom cable guard. When the aileron has been installed, paragraph (4) must be done, and any further adjustments made.*

(5) Assemble rigging plate with face engraved TOP RIGHT uppermost, and position rigging plate on black painted marks on right wing.

(6) Align right aileron trailing edge with neutral mark of rigging plate. Set tensiometer to suit 15 cwt. or 25 cwt. cables as appropriate; position tensiometer on aileron cables, midway between ribs 3 and 4 of the right wing. Adjust turnbuckles connecting cable and tie-rod ends 3B-3B, 3C-3C and 4B-4B to achieve cable tension of 70-80 lb, maintaining trailing edge alignment.

NOTE: *For access to turnbuckles concealed in conduit between frames 11 and 12, temporarily remove rigging pin, and operate control column handwheel.*

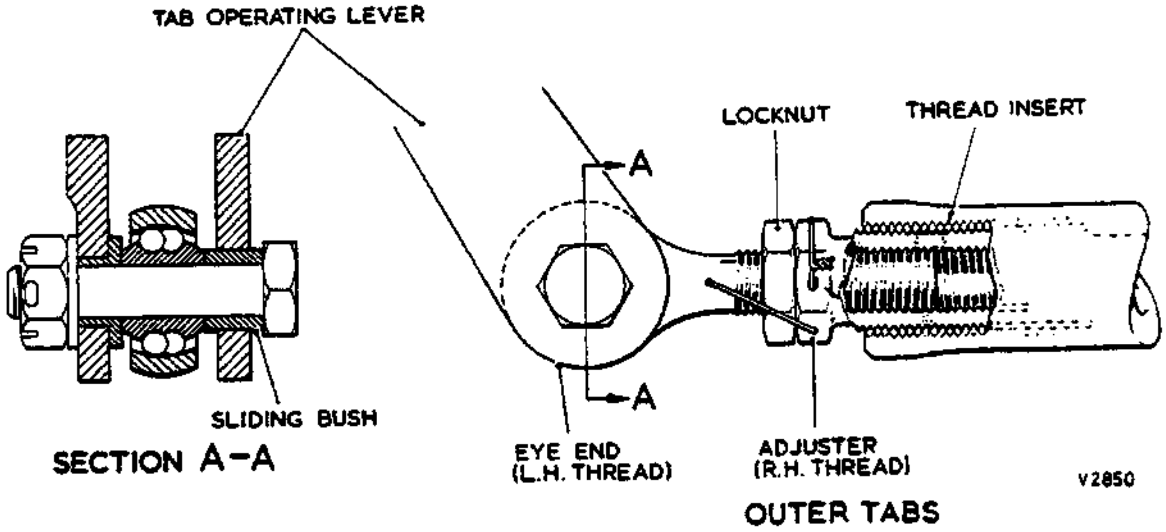
NOTE: *If the aileron is not installed, paragraph (6) can be partially completed at this stage by aligning the cable drum rigging mark with the bottom cable guard. When the aileron has been installed, paragraph (6) must be done, and any further adjustments made.*

(7) In flight compartment:
Remove rigging pin from aileron pulley drum and its mounting.

(8) Check that all turnbuckles are in safety, tighten locknuts, and wire-lock.

(9) Rig left and right geared tabs, refer to paragraph 2.D.

(10) Check aileron range of movement, paragraph 3.D.



Tab connecting rod adjustment and connection
*Figure 504*

(11) Do a functional test of the aileron control system, paragraph 2.E.

B. **Rig aileron trim control system** *(Figure 503, Figure 505, Figure 506)*

(1) Operate aileron trim handwheel to set pointer at neutral. Check that trim drum is wrapped with three turns of each cable, the turns disposed at opposite ends of the drum. If not, remove cable guard from around cable drum, and remove trim drum from shaft sufficiently for access to cable end. Wrap three turns of each cable onto opposite ends of cable drum. Secure trim drum to shaft with washer and nut; lock nut with split pin. Install cable guard and secure with two bolts.

*NOTE: Airplanes Pre Mod. 251017 - Secure cable guard with stiffnut. The adjuster will not normally require adjustment. However, should pointer movement be unequally disposed about the graduated scale neutral mark, reset adjuster by means of serrations on adjuster and washer to achieve equalised movement. Secure adjuster and washer with bolt and stiffnut.*

(2) Check that chain is equally disposed about sprocket mounted on wing rear spar (*Figure 505*). If necessary, adjust turnbuckles connecting cable ends 11B-11B, 11C-11C, 12B-12B and 12C-12C to dispose chain equally about sprocket. Set tensiometer to suit 5 cwt. cables; position tensiometer as shown (*Figure 505*), and tension cables to 25-30 lb, maintaining chain disposition.

*NOTE: Lower flaps to LND position for access to turnbuckles aft of spar.*

(3) Check that all turnbuckles are in safety, tighten locknuts, and wire-lock.

(4) With flaps still lowered, check that trim jack is at neutral position that is, the corners of nuts on fork-ends are aligned with rigging face . (*Figure 505*).

NOTE: *If the trim jack is not at the neutral position, it must be removed and installed to obtain the correct relationship of the chain disposition to trim jack fork-end position (Chapter 27, AILERON TRIM JACK).*

(5) Assemble rigging plate with face engraved TOP LEFT uppermost, and position rigging plate on black painted marks on left wing. Align aileron trailing edge with rigging plate neutral mark.

(6) Check that trim tab is at neutral position (*Figures 503, 506*). If necessary, rig aileron trim tab; refer to paragraph C.

NOTE: *If trim tab is not at neutral position shown, refer to aircraft Log Book for any record of trim tab position peculiar to that airplane before rigging the tab.*

(7) Remove rigging plate from airplane.

(8) Check aileron trim tab range of movement, refer to paragraph 3.E.

(9) Do a functional test of the aileron trim control system, refer to paragraph 2.F.

**C. Rig aileron trim tab** (*Figure 503, Figure 504, Figure 506*).

(1) Remove fairing, and disconnect rods from trim tab.

(2) Check and record aileron control circuit static friction, refer to paragraph 3.F.

(3) Check that the force required to operate aileron trim handwheel from stop to stop is uniform throughout the range, and not excessive.

NOTE: *In paragraphs (2) and (3) make sure that trim tab connecting rods do not foul any structure.*

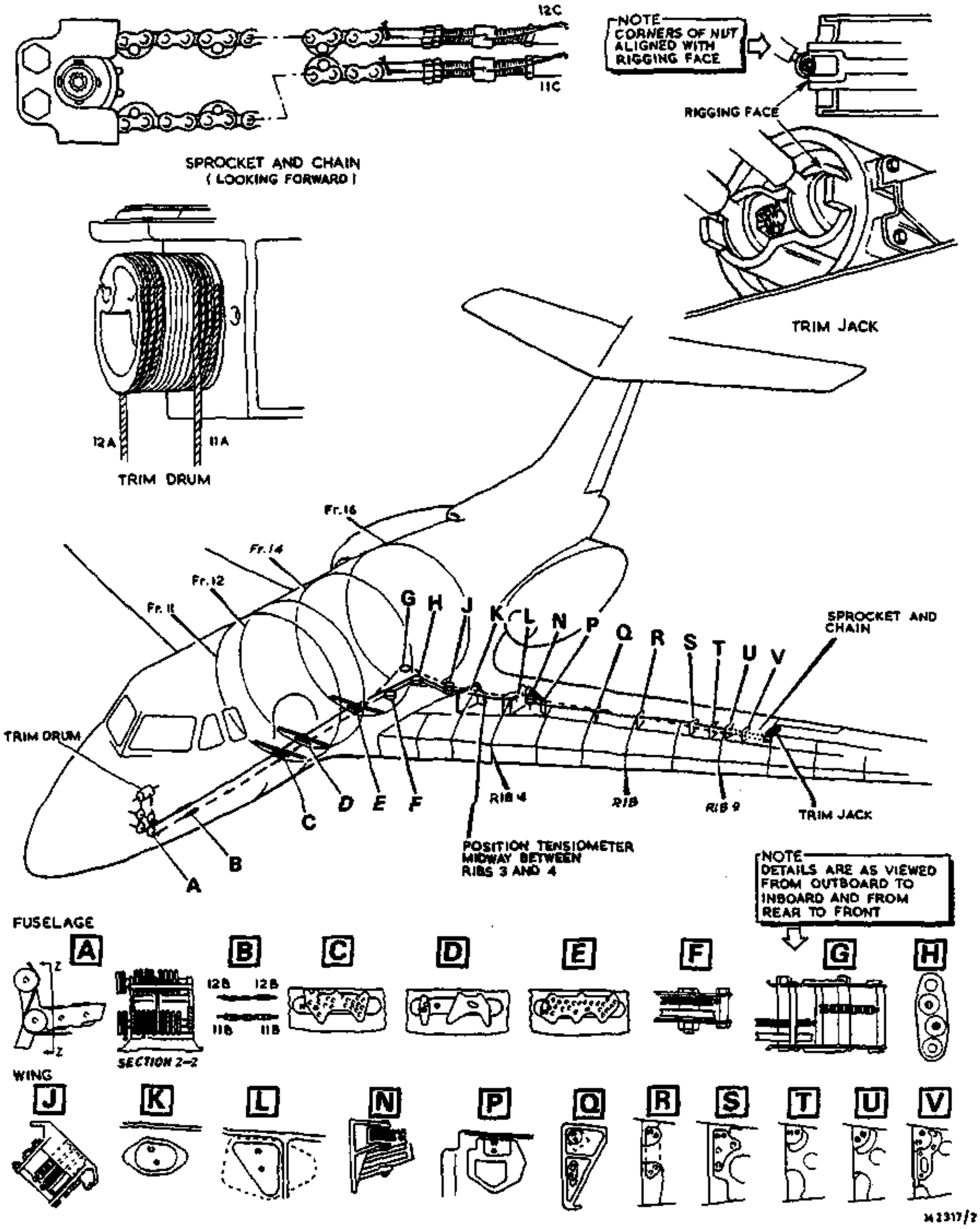
(4) Secure connecting rods to trim tab with bolts, washers and nuts making sure that sliding bushes are free to move, and assembly is made with grease item 078; lock nuts with split pins.

(5) Establish the mean chord line of the trim tab. A method is shown on *Figure 506, Detail C.*

(6) Adjust trim tab connecting rods in unison to set trim tab to the neutral position, that is, the mean chord line of the tab is in line with the aileron neutral line (*Figure 506, Detail A*). Trim tab connecting rods are adjustable at aft end only (*Figure 504*). The adjusted length of one rod must not tend to compress or tension the other rod.

NOTE: *If the trim tab is not at neutral position shown (Figures 503, 506) refer to the aircraft Log Book for any record of trim tab position peculiar to that airplane.*

NOTE: *After the aileron or the aileron trim control system has been rigged, subsequent flights may show that aileron trim is required to maintain laterally level flight (with flaps up and symmetric power). To obtain neutral trim indication in these flight conditions, adjust the trim tab connecting rods to set the tab at neutral ± 3 deg. Record the position to which the tab has been rigged away from neutral in the aircraft Log Book.*



NOTE
CORNERS OF NUT
ALIGNED WITH
RIGGING FACE

POSITION TENSIOMETER
MIDWAY BETWEEN
RIBS 3 AND 4

NOTE
DETAILS ARE AS VIEWED
FROM OUTBOARD TO
INBOARD AND FROM
REAR TO FRONT

Aileron trim control system rigging

*Figure 505*

(7) Check aileron control circuit static friction, refer to paragraph 3.F. If there is any increase in the static friction from that measured in paragraph (2), the increase must be relieved by making sure that there is no tendency for one trim tab connecting rod to compress or tension the other rod. Similarly reduce any increase in the force required to operate the aileron trim handwheel.

(8) Tighten trim tab connecting rod locknuts, and wire-lock eye ends to adjusters. Install fairing.

D. **Rig left and right aileron geared tabs** *(Figure 501, Figure 503, Figure 504, Figure 506).*

(1) Insert rigging pin through rigging holes in aileron pulley drum and its mounting *(Figure 501).*

(2) Operate aileron trim handwheel to set pointer at neutral position.

*NOTE: Neutral trim indication does not necessarily achieve the tab neutral position required in paragraph (4).*

(3) Establish the mean chord lines of the aileron geared tab trailing edges. A method is shown on *Figure 506, Detail C.*

(4) On the left aileron, check that the trim tab is neutral and its mean chord line aligns with the aileron trailing edge neutral line *(Figure 506, Detail A).* Check that the mean chord line of the geared tab is neutral, that is, 0.49 in. ± 0.02 in. above and parallel to the line of the trim tab mean chord line and aileron trailing edge neutral line.

*NOTE: It is recommended that a plate (approx.18 in. x 4 in.) is locally manufactured and drilled to match the three tooling holes located on the aileron inner end rib. With this plate temporarily pegged to the end of the aileron, it would assist in locating the rigging lines required above.*

(5) On the right aileron, check that the mean chord line of the geared tabs is neutral, that is, 0.49 in. ± 0.02 in. above and parallel to the aileron trailing edge neutral line *(Figure 506, Detail B).*

*NOTE: The angular relationship of the aileron and geared tab at neutral is shown (Figure 503), but the linear dimensions are used to set the tab to neutral.*

(6) Check free movement (backlash) of aileron trim and geared tabs, paragraph 3.G. If it is necessary to adjust geared tabs to neutral, complete paragraphs (7) to (12).

(7) Remove panel in fairing (Mod. 251581). Disconnect connecting rods from geared tabs.

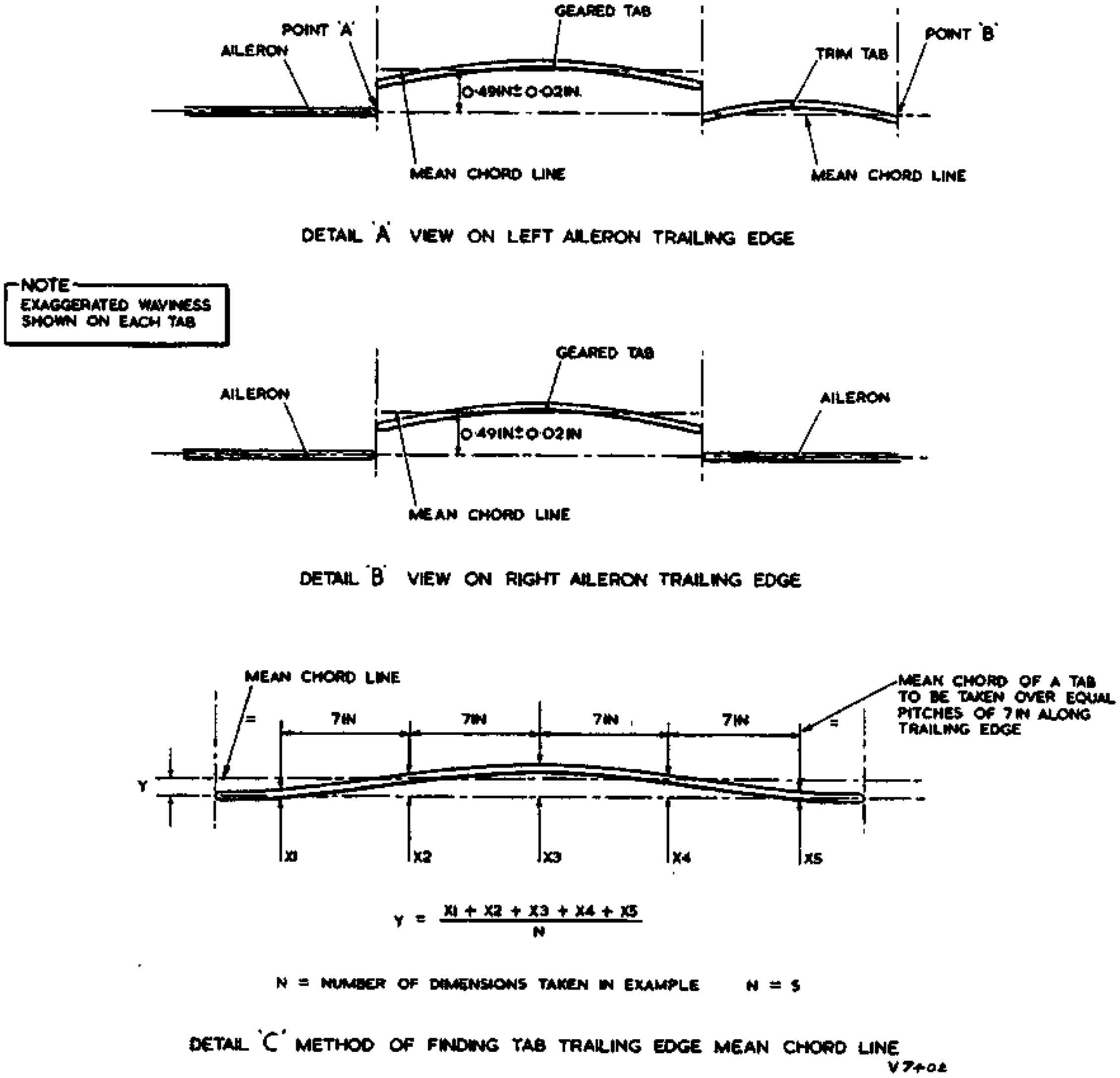
*NOTE: The inner race of the rod eye end is easily dislocated; to prevent this occurring, protect eye end from inadvertent disturbances when bolts are removed.*

(8) Check and record aileron control circuit static friction, paragraph 3.F.

*NOTE: Make sure that geared tab connecting rods do not foul the surrounding structure.*

(9) Secure connecting rods to geared tab with bolts, washers and nuts making sure that sliding bushes are free to move, and assembly is made with grease, item 078; lock nuts with split pins.

(10) Adjust geared tab connecting rods in unison to set tab to neutral position defined in paragraph (4), rods are adjustable at aft end only *(Figure 504).* The adjusted length of one rod must not tend to compress or tension the other rod


POINT 'A'
AILERON
GEARED TAB
0.49IN±0.02IN
TRIM TAB
POINT 'B'
MEAN CHORD LINE
MEAN CHORD LINE
DETAIL 'A' VIEW ON LEFT AILERON TRAILING EDGE
NOTE
EXAGGERATED WAVINESS SHOWN ON EACH TAB
AILERON
GEARED TAB
0.49IN±0.02IN
AILERON
MEAN CHORD LINE
DETAIL 'B' VIEW ON RIGHT AILERON TRAILING EDGE
MEAN CHORD LINE
=
7IN
7IN
7IN
7IN
=
MEAN CHORD OF A TAB TO BE TAKEN OVER EQUAL PITCHES OF 7IN ALONG TRAILING EDGE
Y
X1
X2
X3
X4
X5
Y = (X1 + X2 + X3 + X4 + X5) / N
N = NUMBER OF DIMENSIONS TAKEN IN EXAMPLE N = 5
DETAIL 'C' METHOD OF FINDING TAB TRAILING EDGE MEAN CHORD LINE
V7404

Aileron trim tab and geared tab rigging details

*Figure 506*

(11) Check aileron control circuit static friction, paragraph 3.F. If there is any increase in the static friction from that measured in paragraph (8), the increase must be relieved by making sure that there is no tendency for one rod to compress or tension the other rod.

(12) Tighten geared tab connecting rod locknuts, and wire-lock eye ends to adjusters. Install panel in faring (Mod. 251581).

(13) Check aileron range of movement, paragraph 3.D.

(14) Do a functional test of the aileron control system, paragraph 2.E.

**E. Functional test of aileron control system** *(Figure 503)*

(1) Operate control column handwheel to align rigging marks at top of columns, and make sure that left and right ailerons are at neutral.

(2) Operate control column handwheel through full range, and check that the ailerons move in the correct sense. Check the ailerons for full and free movement, making sure that range of movement is determined by the primary stops.

(3) Apply full raise left wing trim at aileron trim handwheel; operate control column handwheel, and check the ailerons for full and free movement between primary stops.

(4) Apply full raise right wing trim at aileron trim handwheel; operate control column handwheel, and check the ailerons for full and free movement between primary stops.

### F. Functional test of aileron trim control system *(Figure 503)*

(1) Operate aileron trim handwheel from stop to stop; check that pointer moves over full scale, and that pointer and tab move in correct sense.

(2) Operate aileron trim handwheel to set pointer at neutral position, and check that trim tab is at neutral position.

*NOTE: If the trim tab is not at neutral position, refer to the aircraft Log Book for any record of trim tab position peculiar to that airplane before rigging the system.*

(3) Operate control column handwheel to apply full left aileron up, and check aileron trim handwheel for full and free operation between stops.

(4) Operate control column handwheel to apply full right aileron up, and check aileron trim handwheel for full and free operation between stops.

## 3. Inspection/Check

### A. Check rigging of aileron control system *(Figure 501)*

(1) In flight compartment:
Insert rigging pin through rigging holes in aileron pulley drum and its mounting. Check that rigging marks at top of columns are aligned.

(2) Assemble and position rigging plate, with face engraved TOP LEFT upper most, on black painted marks on left wing. Check that aileron trailing edge aligns with neutral mark of plate.

(3) Assemble rigging plate with face engraved TOP RIGHT uppermost, and position it on black painted marks on right wing. Check that aileron trailing edge aligns with neutral mark of plate.

(4) Set tensiometer to suit 15 cwt. or 25 cwt. cables as appropriate and position it midway between ribs 3 and 4 of the left wing, and again, midway between ribs 3 and 4 of the right wing. Check that in both cases the cable tension is 70-80 lb.

(5) Remove rigging pin from pulley drum.

(6) Remove rigging plate from airplane.

### B. Check rigging of aileron trim control system *(Figure 506)*.

(1) Operate aileron trim handwheel to set pointer at neutral position. Check that trim drum is wrapped with three turns of each cable, the turns disposed at opposite ends of the drum.

(2) Check that chain is equally disposed about sprocket on left wing rear spar.

(3) Set tensiometer to suit 5 cwt. cables, and position it as shown. Check that cable tension is 25-30 lb.

(4) Check that trim jack is at neutral position, that is the corners of nuts on fork-ends are aligned with rigging face.

(5) Assemble rigging plate with face engraved TOP LEFT uppermost, and position it on black painted marks on left wing. Align aileron trailing edge with neutral mark on plate.

(6) Establish the mean chord line of the trim tab. A method is shown on *Figure 506, Detail C.* Check that the trim tab is neutral, that is, its mean chord line aligns with the aileron neutral line *(Figure 506, Detail A).*

*NOTE: If the trim tab is not at neutral position, refer to the aircraft Log Book for any record of trim tab position peculiar to that airplane before rigging the system.*

**C. Check rigging of aileron geared tabs** *(Figure 506)*

(1) In flight compartment insert rigging pin through rigging holes in aileron pulley drum and its mounting.

(2) Operate aileron trim handwheel to set pointer at neutral position.

*NOTE: Neutral trim indication does not necessarily achieve the tab neutral position required in paragraphs (4) and (6).*

(3) Assemble and position rigging plate, with face engraved TOP LEFT uppermost, on black painted marks on left wing. Check that aileron trailing edge aligns with 'neutral' mark on plate.

(4) Make sure that trim tab mean chord line aligns with aileron trailing edge neutral line.

(5) Establish the mean chord line of the left wing geared tab. Check that the geared tab is neutral, that is, its mean chord line is 0.49 in. ± 0.02 in. above and parallel to the line of the trim tab mean chord line and aileron trailing edge neutral line.

(6) Assemble rigging plate with face engraved TOP RIGHT uppermost, on black painted marks on right wing. Check that aileron trailing edge aligns with 'neutral' mark on plate.

(7) Establish the mean chord line of the right aileron geared tab. Check the geared tab is neutral, that is, its mean chord is 0.49 in. ± 0.02 in. above and parallel to the aileron trailing edge neutral line.

(8) Remove rigging pin from pulley drum.

(9) Remove rigging plates from airplane.

**D. Check aileron range of movement** *(Figure 503)*

(1) Assemble rigging plate with face engraved TOP LEFT uppermost, and position it on black painted marks on left wing.

(2) Operate control column handwheel through full range, and check that when left aileron movement is limited by the primary stops, the trailing edge lies within the limits of the rigging plate graduations at the up and down positions. Using an inclinometer, measure and record the actual total aileron movement (angle A) and the values of angles X and Y for the geared tabs.

*NOTE: The primary stops consist of one pair of contacting stop faces at each inboard hinge; these limit up movement of the associated aileron. Down movement of an aileron is limited when the up stop of the opposite aileron takes effect. It is not anticipated that the stops will require adjustment; should adjustment be necessary, Chapter 27, AILERON.*

(3) Assemble rigging plate with face engraved TOP RIGHT uppermost, and position it on black painted marks on right wing.

(4) Repeat paragraph (2) for right aileron and geared tabs.

(5) Check the servo movement of the outer left geared tab to the following formula, using the information recorded in paragraph (2).

$$\frac{X + Y}{\text{Recorded total aileron movement}} = 0.88 \pm 0.01$$

(6) Repeat paragraph (5) for the right geared tab.

E. **Check aileron trim tab range of movement** *(Figure 503)*

(1) Operate aileron trim handwheel from stop to stop. Check that trim tab movement is within limits shown.

*NOTE: If the trim tab is not at neutral position, refer to the aircraft Log Book for any record of trim tab position peculiar to the airplane. Check that trim tab movement is equal about position recorded in Log Book, and to the limits shown.*

F. **Check aileron control circuit static friction** *(Figure 507)*

(1) Do this check with the circuit rigged and complete, including the ailerons and tabs.

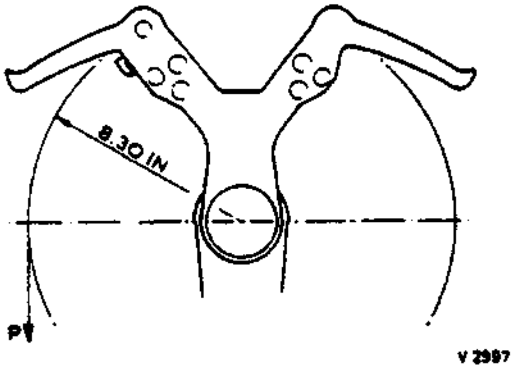
(2) Arrange a spring balance to measure the load required to operate the control column handwheel; apply load P as shown.

(3) Record the loads required to operate the control column to raise the left aileron and then the right aileron. The maximum permissible loads are:

2.5 lb break out left and right of neutral

3.0 lb break out of any point more than 1 in. to left and right of neutral.

*NOTE: If the aileron control circuit static friction exceeds these limits, and there is no apparent cause, determine the column friction separately (Chapter 27, CONTROL COLUMN).*



Aileron control circuit static friction
*Figure 507*

### G. **Check free movement of aileron and aileron tabs** *(Figure 502)*

(1) Make sure that no movement of the pulley drum, associated with the 'A' lever, occurs while the free movement of the aileron is being measured.

(2) Use an inclinometer to measure free movement of aileron: the maximum permissible free movement is 0 degrees 30 minutes.

(3) Make sure that no pivotal movement of the aileron occurs while the free movement (backlash) of the trim or geared tabs is being measured.

NOTE: *The following operation must be done on the aileron inner and outer geared tabs (left and right wings) and aileron geared trim tab (left wing only).*

(4) Remove trim tab rod fairings, and geared tabs faring panels (Mod. 251581). Disconnect one connecting rod from tab, and check that free movement (backlash) measured at tab trailing edge does not exceed 0.06 in. Making sure that the sliding bush is free to move, lubricate assembly with grease, item 078, and install bolt, washer and nut. Repeat check with second rod disconnected. Tighten nuts and lock with split pins. Install fairings and if applicable fairing panels.

## CONTROL COLUMN - MAINTENANCE PRACTICES

### 1. Unit servicing

A. Lubrication

For routine lubrication data refer to the Maintenance Schedule.

### 2. Removal/Installation (Fig. 201)

NOTE : The following procedures apply to the left and right control column except where specified.

A. Remove control column

(1) Isolate the autopilot cut-out switch, stick shaker (if applicable) and audio I/C-OFF-R/T control switch electrical circuits (see Chapter 24, GENERAL).

(2) Remove relevant crew seat (see Chapter 25, CREW SEATS).

(3) If fitted, remove flight compartment carpets (Chapter 25).

(4) Remove fairing from flight compartment left and right side consoles.

(5) Remove cover from left and right side of control pedestal.

(6) Disconnect cable between rudder pedal adjustment unit and operating lever from the operating lever.

(7) If applicable remove stick shaker unit (see Chapter 34, STICK SHAKER UNIT).

(8) Remove bolt securing zip and detach gaiter from column and gaiter mounting.

(9) Remove gaiter mounting.

(10) Remove seal ring around rudder pedal adjustment unit.

(11) Remove panel from between rudder pedals.

(12) Remove duct and guard panel assembly from side of right crew seat support structure.

(13) Remove shroud and duct from floor, in front of right crew seat support structure.

(14) Remove access cover aft of right control column.

(15) Remove G weight connecting rod tunnel aft of left control column.

(16) Remove centre floor panel, and left and right inboard and outboard floor panels.

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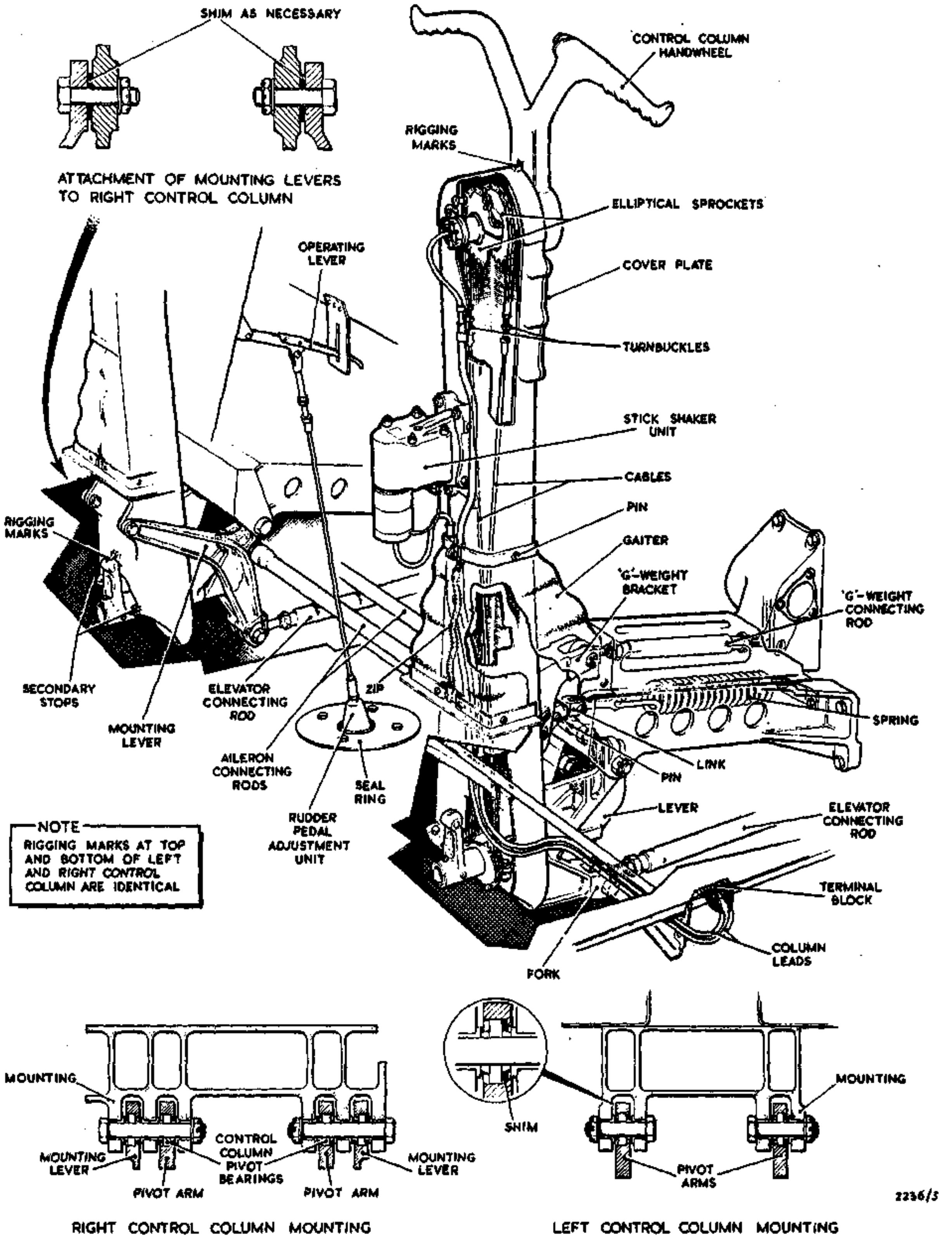


ATTACHMENT OF MOUNTING LEVERS TO RIGHT CONTROL COLUMN

NOTE
RIGGING MARKS AT TOP AND BOTTOM OF LEFT AND RIGHT CONTROL COLUMN ARE IDENTICAL

RIGHT CONTROL COLUMN MOUNTING

LEFT CONTROL COLUMN MOUNTING

Control column installation
Fig. 201

... Control column - Maintenance practices continued

(17) Disconnect control column electrical cables from terminal block (CQ left, CR right).

(18) Remove the P-clips which secure the control column electrical cables to the floor beam.

(19) Remove panel on left pilot's seat support structure. Move column aft to raise G weight, and temporarily secure G weight in the fully up position.

(20) Left control column : Disconnect G weight connecting rod from G weight bracket.

NOTE : Turn and push bolts clear of circlips in bracket.

(21) Left control column : Disconnect the link between spring and G weight bracket.

NOTE : Move control column aft, and allow pin in link to contact structure. Pin will maintain link in suitable position for control column installation.

(22) Left control column : Disconnect aileron and elevator connecting rods from lever fork end at base of column.

Right control column : Disconnect aileron and elevator connecting rods from lever and mounting levers at base of column.

NOTE : To remove aileron connecting rods, turn and push bolts clear from circlips in levers (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

(23) Remove bolts securing pivot arms (left control column) or pivot arms and mounting levers (right control column) to mounting, and remove control column.

(24) Right control column: Remove the two mounting levers.

B. Install control column

Special tools and equipment :-

| | |
|---|---|
| Rigging pin set | BAe 25-7Y15A |
| Inclinometer | |

(1) Rig control column (para. 3).

NOTE : Operations (2) and (3) are only applicable if a new control column is being fitted. Operations (1), (4) and subsequent apply if the existing control column is being refitted.

...Control column - Maintenance practices continued

(2) Right control column : Locate pivot arms and mounting levers in mounting, and temporarily secure with bolts, washers and nuts.

Left control column : Locate pivot arms in mounting, and temporarily secure with bolts, washers and nuts.

(3) Use a dial test indicator to measure the side-float between control column pivot arms and mounting. Exert side-load necessary to determine the side-float as near control column base as practical. Insert shims, equal in thickness to the reading obtained from the dial test indicator, between control column pivot bearing and pivot arm.

NOTE : Shims may be inserted at either pivot arm.

(4) Right control column : Secure the two mounting levers to column with bolts, washers and nuts; lock nuts with split pins. Ensure that bearings in mounting levers align with control column pivot bearing.

(5) Right control column : Locate pivot arms and mounting levers on mounting lugs and secure with bolts, washers and nuts. To obviate side stresses on mounting levers, shim as necessary between levers and lugs (see Fig.201); lock nuts with split pins.

Left control column : Locate pivot arms in mounting, and secure with bolts, washers and nuts; lock nuts with split pins.

(6) Level the aircraft (see Chapter 8, LEVELLING AND WEIGHING).

(7) Check control column handwheel and control column movements (Fig.202).

(8) Left control column : Locate elevator connecting rod in fork at base of column, and secure with bolt, washer and nut; lock nut with split pin.

Right control column : Locate elevator connecting rod in the mounting levers, and secure with bolt, washer and nut; lock nut with split pin.

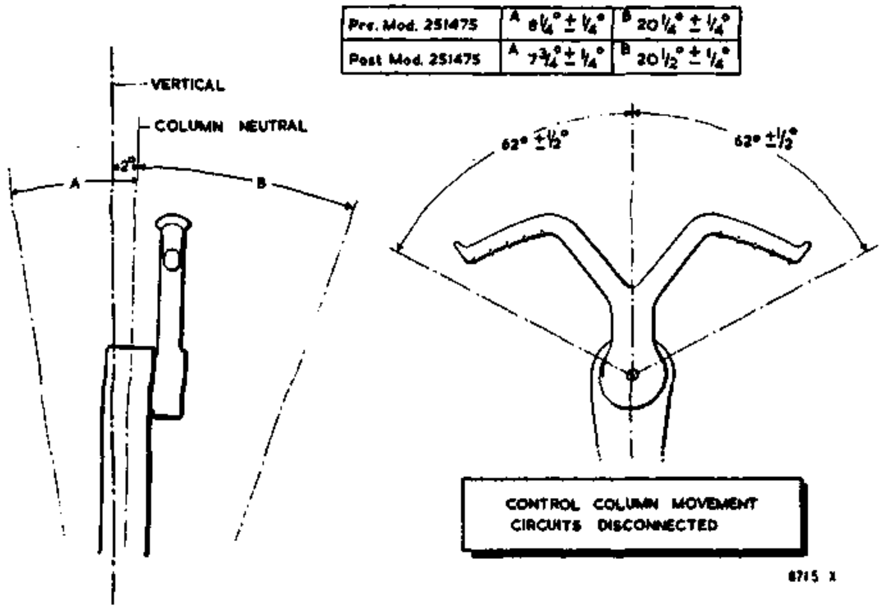
(9) Left control column : Locate two aileron connecting rods in the lever at the bottom of the control column. The rod between left and right control column locates in the lower fork of the lever, and the rod between left control column and aileron pulley drum locates in the upper fork. Secure each rod with bolts, washers and nuts, ensure that bolts engage circlips in lever of left and right control column; lock nuts with split pins (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

Right control column : Locate aileron connecting rod from left control column in lever at bottom of right control column, and secure with bolt, washer and nut; ensure bolt engages circlip in lever; lock nut with split pin.

(10) Left control column : Move control column aft and locate link in G weight bracket, and secure with bolts, washers and nuts; ensure bolts engage circlips in bracket lock nuts with split pins.

(11) Left control column : Locate G weight connecting rod in G weight bracket, and secure with bolt, washer and nut; ensure bolt engages circlip in bracket, and lock nut with split pin. Remove temporary means of securing G weight arm.

... Control column - Maintenance practices continued



| | | |
|---|---|---|
| Pre. Mod. 251475 | A 8¼° ± ¼° | B 20¼° ± ¼° |
| Post Mod. 251475 | A 7¾° ± ¼° | B 20½° ± ¼° |

Control column movements
Fig. 202

(12) Rig aileron control system forward of pulley drum (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

(13) Remove rigging pin from pulley drum, under flight compartment floor.

(14) Rig elevator control system forward of pulley drum (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(15) Remove rigging pin from pulley drum, under flight compartment floor.

(16) Fit and secure stick shaker (Chapter 34).

(17) Secure control column electrical leads to floor beam outboard of control column with two P-clips, screws, washers and stiffnuts. Ensure that control column electrical cables will not impede control column movement.

(18) Connect and secure control column electrical cables to terminal block (CQ left, CR right).

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...Control column - Maintenance practices continued

(19) Reset circuit breakers.

(20) Functionally test autopilot cut-out switch, stick shaker (see Chapter 34, FLIGHT CONTROL and STALL WARNING SYSTEMS) and I/C-OFF-R/T control switch (see Chapter 23, AUDIO INTEGRATING SYSTEM).

(21) Position floor panels on support structure, and secure with bolts.

(22) Position gaiter mounting on floor panels, around column, and secure with bolts.

(23) Secure access cover to floor panels aft of right control column with bolts.

(24) Secure G weight connecting rod tunnel to floor panels aft of left control column with bolts.

(25) Attach gaiter to column, locating pins in each side of column. Close zip, fit bolt through strap at top of gaiter and tab of zip. Fit washer on bolt and secure bolt with stiffnut. Secure bottom of gaiter to gaiter mounting with bolts. Ensure that column movement is not impeded by the gaiter.

(26) Secure seal ring to floor around rudder pedal adjustment unit with bolts.

(27) Connect cable of rudder pedal adjustment unit to operating lever with shear pin. Fit washer and secure shear pin with split pin.

(28) Locate panel between rudder pedals, and secure with bolts.

(29) Secure fairings to flight compartment side consoles.

(30) Secure covers to side of control pedestal.

(31) Mate duct with duct which protrudes from fairing on flight compartment right side; fit distance tube between duct attachment brackets, and secure ducts together with bolt. Secure shroud over duct with Camloc fasteners, which fasten into the floor and seat support structure.

(32) Secure duct and guard panel assembly to side of right crew seat support structure. Leak test pipes and ducting (see Chapter 21, AIR SUPPLY SYSTEM).

(33) If applicable, fit flight compartment carpets.

(34) Fit crew seat (see Chapter 25, CREW SEATS).

(35) Functionally test aileron control system (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

... Control column - Maintenance practices continued

(36) Functionally test elevator control system (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

3. Adjustment/Test

A. Rig control column

(1) Move control column handwheel to align rigging marks at top of control column. Check that rigging marks at bottom of control column are aligned. If necessary, remove cover plate from control column, and adjust turnbuckles to align rigging marks at top and bottom of control column. Check that turnbuckles are in safety, tighten locknuts and wire-lock. Bolt cover to control column.

NOTE : On early aircraft secure electrical cables and P clip with top centre bolt.

CAUTION : DO NOT TENSION COLUMN CABLES EXCESSIVELY OR THE ELLIPTICAL SPROCKETS MAY CAUSE STIFF MOVEMENT AND OVERLOAD THE CHAINS.

(2) Check control column static friction, refer to para. B.

B. Check control column static friction

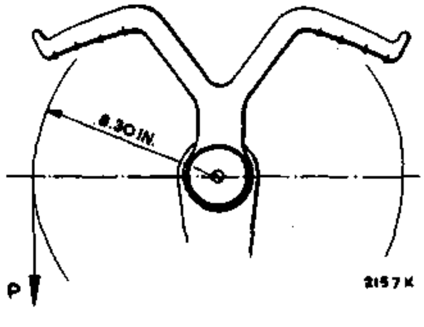
(1) Remove control column from aircraft, refer to para. 2A.

(2) Support control column horizontally.

(3) Arrange a spring balance to measure the load required to operate the control column handwheel; apply load P as shown on Fig. 203.

(4) Record the load required to operate the control column handwheel through its full range. The maximum permissible load is 0. 50 lb.

(5) Install control column, refer to para. 2B.



Control column static friction
Fig. 203

* * *

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# AILERON - MAINTENANCE PRACTICES

## 1. Unit servicing

### A. Lubrication

For routine lubrication data refer to Maintenance Schedule.

## 2. Removal/Installation

NOTE : The following procedures apply to the left and right aileron, except where specified.

CAUTION : DO NOT STRAIN OR DAMAGE TAB CONNECTING ROD EYE ENDS OR OPERATING LEVERS AS SUBSEQUENT FRACTURE MAY OCCUR. DO NOT USE EXCESSIVE FORCE WHEN REMOVING TAB ROD CONNECTING BOLTS.

### A. Remove aileron

(1) Left aileron : Disconnect connecting rods from trim tab operating levers.

NOTE : The rod eye end inner race is easily dislocated; to prevent this occurring, protect eye end from inadvertent disturbance when tab-to-connecting rod bolts are removed.

(2) Support aileron, and remove attachment bolts from outboard and centre links, and from input connecting link.

(3) Remove aileron from wing, complete with tabs, guiding trim tab connecting rods through aileron structure.

(4) If applicable, remove static discharge probes (see Chapter 23, STATIC DISCHARGING).

### B. Checks/Tests before installation

(1) Before fitting an aileron, ensure that if the aileron has been repaired, painted, or a new trim or geared tab fitted, it has also been re-balanced. Refer to the Structural Repair Manual - Chapter 57 for information on re-balancing.

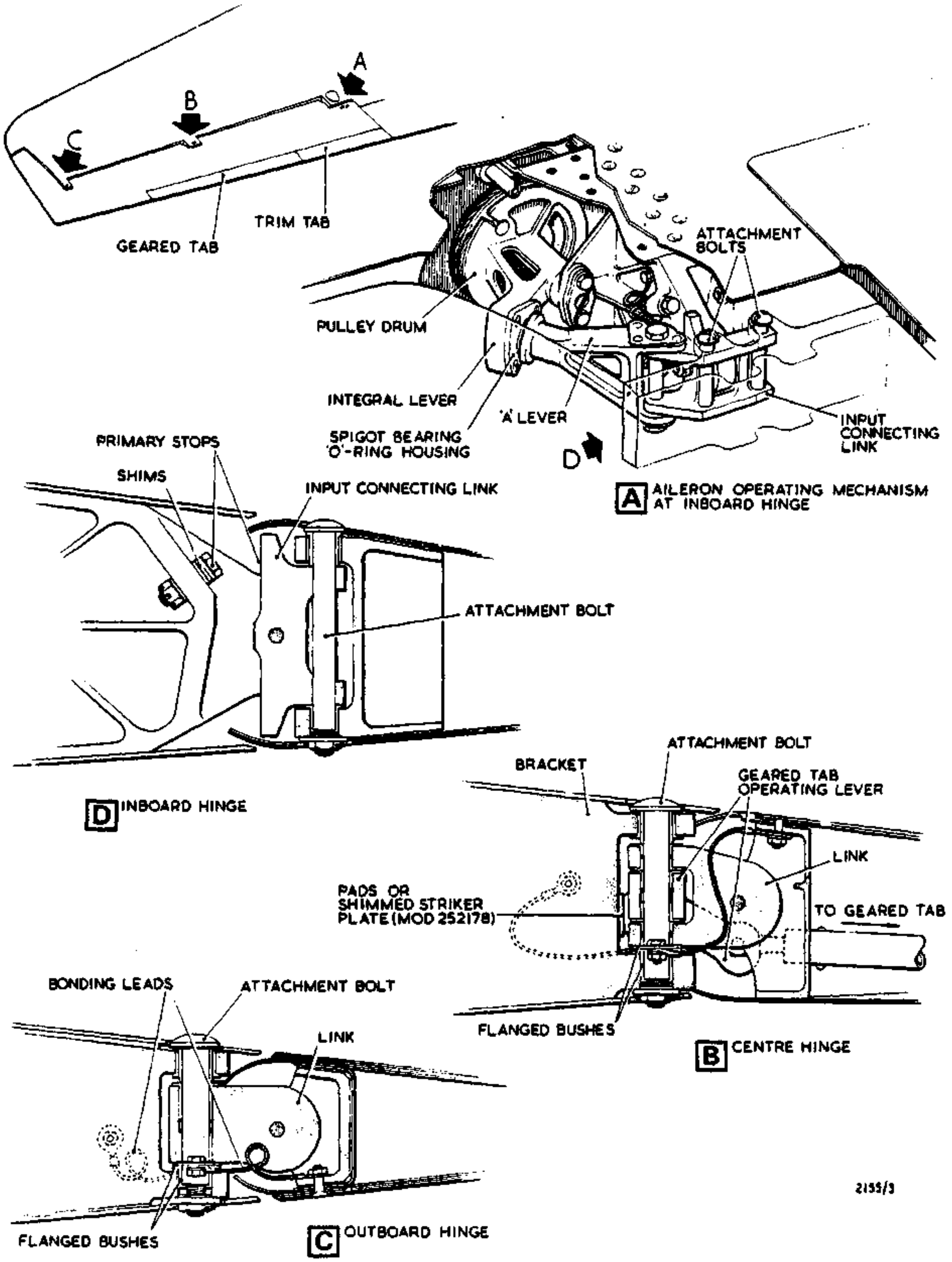
CAUTION : RE-TOUCHING OR PAINTING OVER EXISTING PAINT IS PERMITTED ONLY IF AILERON BALANCE IS RECHECKED AND ADJUSTED AS NECESSARY.

### C. Install aileron

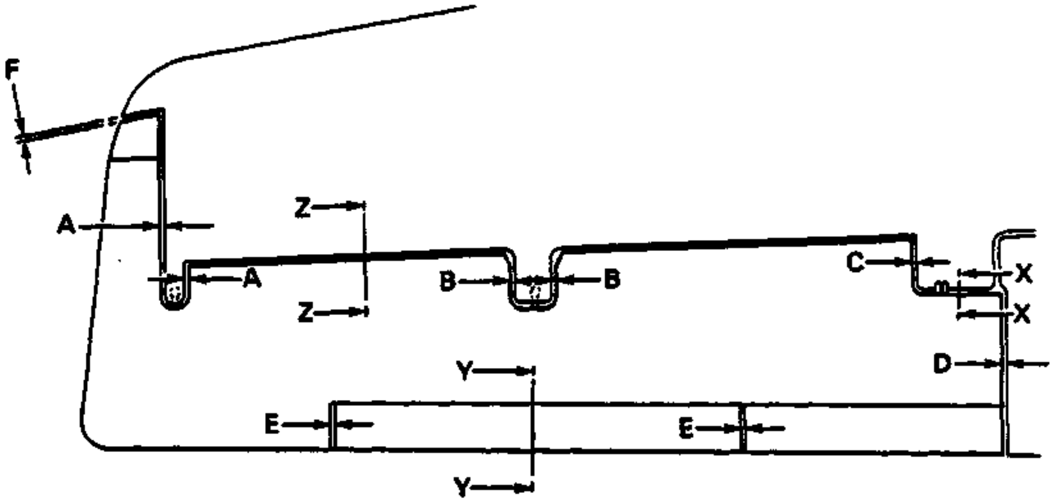
Equipment and materials required :

| | |
|---|---|
| Rigging pins .. .. | 25Y493A |
| Rigging plate .. .. | 25Y283A/B (Pre Mod.255319) |
| Rigging plate .. .. | 25Y801A (Mod.255319) |
| Tensiometer .. .. | T5/2002/401/00 (Teleflex) |
| Inclinometer | |
| Grease, MX-33 .. .. | DTD 900/4630 |
| Grease, low temperature .. | DTD 5598 |

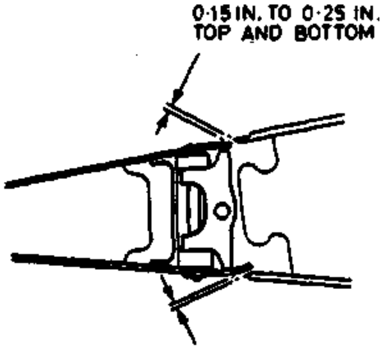
(1) Check that centre and outboard links are assembled correctly, as indicated by label on link.



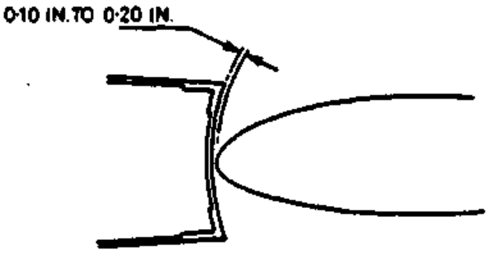
Aileron installation
Fig.201



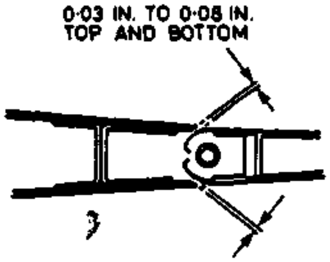
| | |
|---|---|
| A | 0·40 IN. TO 0·25 IN. |
| B | 0·15 IN. TO 0·05 IN. |
| C | 0·45 IN. TO 0·35 IN. |
| D | 0·85 IN. TO 0·65 IN. |
| E | 0·20 IN. TO 0·10 IN. |
| F | 0·20 IN. MIN. |



SECTION X-X
OVER INBOARD HINGE AREA



SECTION Z-Z



SECTION Y-Y

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Aileron and aileron tabs - clearances
Fig.202

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...Aileron - Maintenance practices continued

(2) If detached, secure trim tab connecting rods to trim jack (see Chapter 27, TRIM JACK).

(3) Set aileron trim control to neutral, and check that trim jack is at neutral, (see Chapter 27, TRIM JACK).

(4) To ensure electrical bonding continuity, inspect lower inboard face of input connecting link and flanged bushes in links and brackets for cleanliness and freedom from corrosion.

(5) Smear attachment bolt shanks with grease MX-33, and lubricate all visible parts of the 'A' lever spigot with grease, low temperature.

(6) Left aileron : Enter trim tab connecting rods into aileron.

(7) Locate outboard and centre links in brackets on wing rear spar. Locate input connecting link in bracket on aileron front spar. Secure links to brackets with bolts and nuts; torque tighten nuts to 40 lb in. /60 lb in. and lock with split pins.

NOTE : If holes in bracket and geared tab operating lever are not aligned, adjust length of one of the connecting rods linking gear tab operating lever to tab. This adjustment will bring two pads on the geared tab operating lever into parallel with faces on the bracket, and allow the holes to align.

With nuts fully tightened there should still be a clearance between attachment bolt head and bracket.

(8) Left aileron : Secure connecting rods to trim tab operating levers with bolts, washers and nuts; lock nuts with split pins.

NOTE : With nuts fully tightened, there should still be a clearance between bolt head and operating lever.

(9) Insert rigging pin through rigging pin holes in aileron pulley drum and its mounting, and rig aileron control system aft of pulley drum (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

(10) If aileron range of movement is out of limits, correct by adjusting shims under stop bolt in inboard hinge bracket. After adjustment, secure stop bolt and shims with nut, and lock nut with split pin.

(11) Check neutral setting of trim tab and adjust as necessary (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

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...Aileron - Maintenance practices continued

(12) Check trim tab range of movement, refer to Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS.

(13) Functionally test aileron trim control system, refer to Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS.

(14) Check clearances shown on Fig.202.

(15) Check free movement of aileron and aileron tabs, refer to Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS.

(16) If applicable, fit static discharge probes (see Chapter 23, STATIC DISCHARGING).

(17) Check electrical bonding of aileron to wing (see Chapter 20, Bonding for electrical continuity).

## 3. Approved repairs

Materials required:-

| | |
|---|---|
| Grease, low temperature .. .. .. | DTD 844, 866 or 5598 |
| Thiokol .. .. .. | PR 1301 |

### A. Assembly of aileron A - lever spigot bearing (Fig.201)

NOTE: (1) Spigot bearing in integral lever and A-lever spigot to be assembled with grease.

(2) Spigot bearing O-ring housing to be assembled with Thiokol to HSA Spec. S26-1001 (see Chapter 20). Ensure that Thiokol does not contaminate bearing.

* * *

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## AILERON TRIM JACK - MAINTENANCE PRACTICES

1. Unit servicing

A. Lubrication

For routine lubrication data refer to the Maintenance Schedule.

2. Removal/Installation

A. Remove trim jack

CAUTION : TRIM JACKS ARE INDIVIDUALLY ADJUSTED ON INSTALLATION, AND ARE NOT INTERCHANGEABLE. LABEL TRIM JACKS FOR IDENTIFICATION.

(1) Remove left aileron (see Chapter 27, AILERON).

(2) Select flaps to LND position.

NOTE : If hydraulic pressure is insufficient to operate flaps, use pump in rear equipment bay (see Chapter 29, MAIN SYSTEM) to obtain hydraulic pressure.

(3) Remove access panel from left wing lower skin at aileron inboard end.

(4) Set aileron trim control on control pedestal to neutral position.

(5) To prevent movement of torque shaft due to cable tension, temporarily secure torque shaft to adjacent structure.

(6) Support trim jack and remove bolts securing trim jack to inboard hinge bracket and mounting bracket. Remove trim jack.

(7) Operate trim jack by hand to extend fork-ends; remove bolts and nuts and detach connecting rods from fork-ends. Refit bolts and nuts in fork-ends.

NOTE : Do not extend fork-ends more than is necessary to remove bolts, or fork-ends become disengaged from jack.

Do not tilt rod bearings more than 6° or seals may be damaged.

B. Install trim jack

Materials required :

| | |
|---|---|
| Grease, low temperature ... | DTD 844, 866 or 5598 |
| Grease, MX-33 (pre Mod.25/2728) | DTD 900/4630 |
| Jointing compound ... | DTD 900/4488 |

NOTE : Trim jacks are not interchangeable, it is only permissible to install a trim jack with an undrilled end-cap, or refit the jack which was previously in this position. For the latter, the procedure ends at operation (9).

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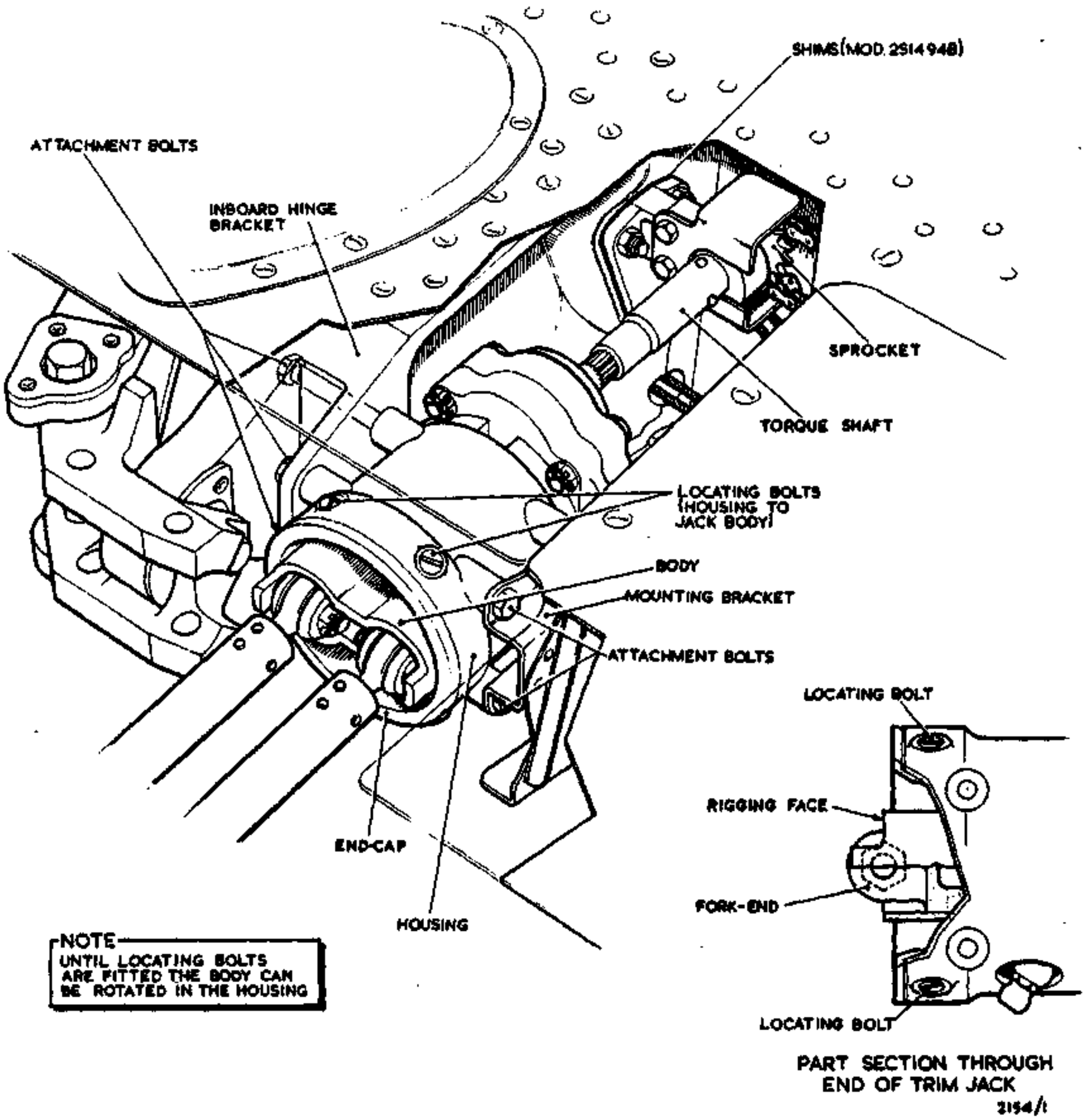
...Aileron trim jack - Maintenance practices continued



Trim jack installation
Fig. 201

(1) Operate trim jack and extend fork-ends to allow attachment of connecting rods to trim jack.

NOTE : Do not extend fork-ends more than necessary to fit bolts, or fork-ends will become disengaged from jack.

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...Aileron trim jack - Maintenance practices continued

(2) Attach connecting rods to fork-ends with bolts and nuts supplied with jack; tighten nuts and lock with split pins; ensure that the following conditions are met:-

(a) Care must be exercised when entering rod eye ends into fork-ends; if the inner race tilts more than 6°, the seals may be damaged.
(b) That nuts butt against shoulders on fork-ends.
(c) Split pins are fitted in line with axis of fork-ends movement.
(d) Drain holes are in lower surface of rod.

(3) Check that trim chain is equally disposed about sprocket.

(4) Operate trim jack by hand to neutral position; this is achieved when the centre of the hole in the fork-end is aligned with the rigging face, see Fig.201.

NOTE: When the connecting rods are fitted, aligning the corners of the nuts on the fork-ends with the rigging face will achieve this condition.

(5) Smear trim jack serrated shaft with grease, low temperature.

(6) Position trim jack between inboard hinge bracket and mounting bracket. Engage torque shaft with serrated shaft of trim jack. Coat bolts with jointing compound; secure trim jack to mounting bracket and inboard hinge bracket with bolts.

NOTE: Provision for alignment of the torque shaft to trim jack shaft is made by shimming between the sprocket mounting bracket and the inboard hinge bracket. If shims are removed or additional shims fitted, the aileron trim control cables must be re-tensioned (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEM).

(7) Remove temporary means of securing torque shaft.

(8) Fit left aileron, (see Chapter 27, AILERON).

NOTE: If a trim jack with an undrilled end-cap is being fitted, the aileron and trim tab movements cannot be finally checked until the locating bolts (Fig.201) are fitted. However, during operations (10) and (11), it is essential that the full and free movement is not curtailed.

(9) Lubricate trim jack through the two nipples with grease, MX-33 (pre Mod.25/2728) or DTD 5598 (Mod.25/2728).

NOTE : These two greases must not be mixed.

(10) To prevent trim jack operating effort increasing at extremes of aileron movement, it is essential that centres of fork-ends lie on a line parallel to the aileron hinge line. To achieve this condition, make small rotational adjustments to the position of the jack body in the housing; lock the body after each adjustment to prevent unintentional rotation.

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...Aileron trim jack - Maintenance practices continued

(11) After each adjustment, check the trim jack operating effort over the full trim range, while the aileron is operated over the full range between stops. (See Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

(12) When a uniform operating effort is achieved, secure end-cap to housing in the following manner. Drill four 0.1935 in. dia. holes in the end-cap from existing holes in housing. Coat bolts with jointing compound, and secure with bolts and stiffnuts.

(13) Functionally test aileron trim control system, (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

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## AILERON SERVO MOUNTING - MAINTENANCE PRACTICES

NOTE : The aileron servo mounting must be removed to change the cables connecting the aileron pulley drum to the servo mounting.

To gain access to the cables connecting the aileron pulley drum to the servo mounting, carry out operations in para. A, (1) to (8).

1. Removal/Installation (Fig. 201)

A. Remove servo mounting

(1) Remove duct and guard panel assembly.

(2) Remove shroud and duct, situated on floor in front of frame 5.

(3) Isolate electrical circuits relevant to components mounted on equipment tray (Chapter 24).

(4) Remove equipment tray and blank off disconnected pitot static pipes and unions on components.

(5) Isolate electrical circuits relevant to inverters (Chapter 24).

(6) If fitted, remove inverter(s); remove inverter mounting bracket.

(7) Remove aileron servo from servo mounting (Chapter 34).

(8) Remove fairing from flight compartment right side console.

(9) Remove cover from right side of control pedestal.

(10) Disconnect cable between right rudder pedal adjustment unit and operating lever (see Chapter 27, CONTROL COLUMN).

(11) Remove bolt securing zip, and detach gaiter from right column and gaiter mounting. Remove gaiter mounting (see Chapter 27, CONTROL COLUMN).

(12) Remove seal ring around right rudder pedal adjustment unit (see Chapter 27, CONTROL COLUMN).

(13) Remove panel from floor, between right rudder pedals.

(14) Remove access cover from floor, aft of right control column.

(15) Remove centre floor panel, and right side inboard and outboard floor panels.

(16) Slacken locknuts and adjustment bolts in aileron pulley drum.

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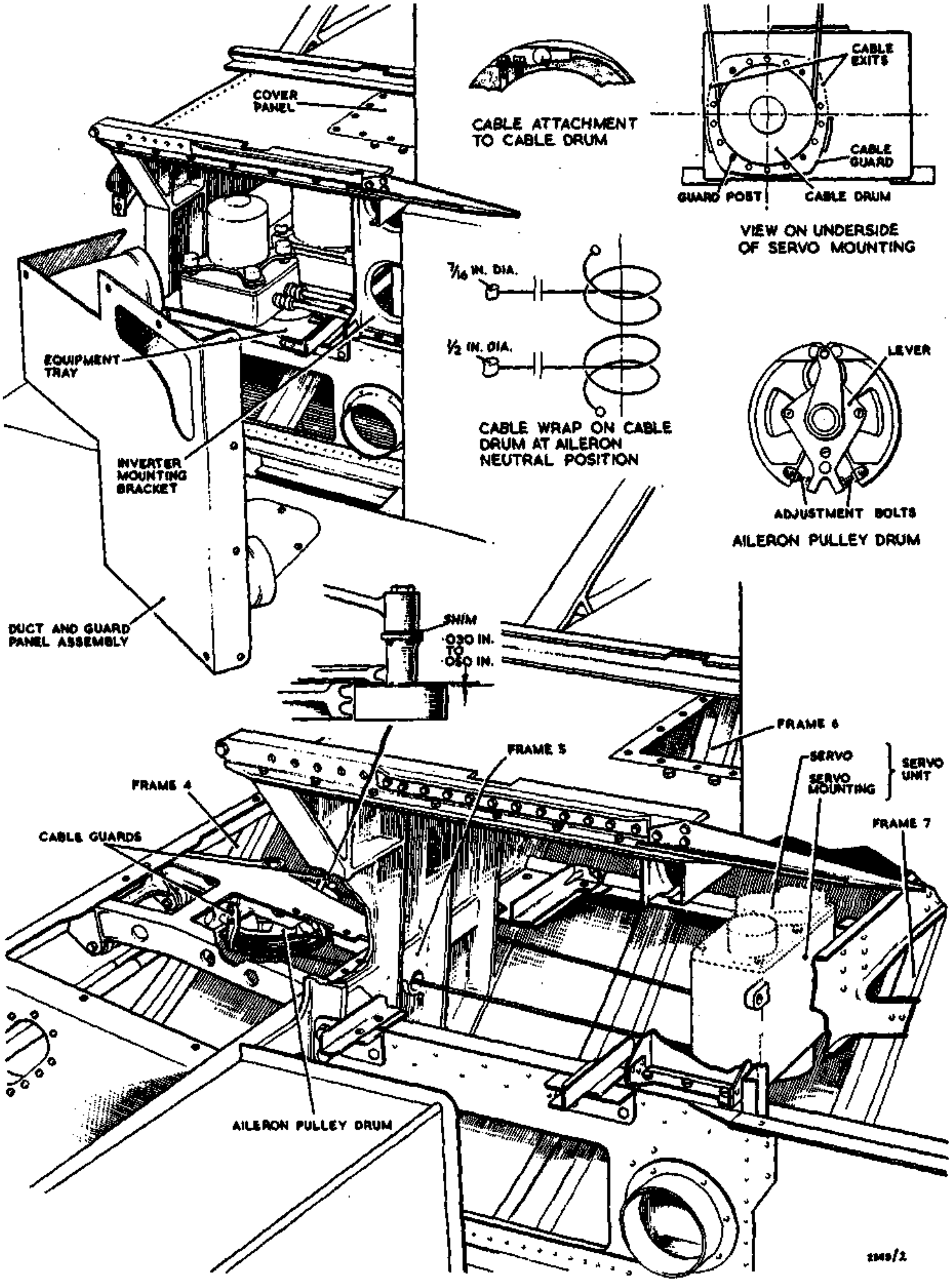

Servo mounting installation
Fig.201

...Aileron servo mounting - Maintenance practices continued

(17) Remove aileron pulley drum pulley guards.

NOTE: Retain the shim after removing the lower circular part of the right cable guard; the left guard must be detached from the mounting.

(18) Remove servo mounting from structure, and disengage cables from aileron pulley drum.

NOTE: Post Mod 251409, additional adjustment for cables is provided by packing pieces at servo-mounting. Retain these packing pieces.

(19) Remove cable guard and guard posts from servo mounting. Retain cable guard.

(20) Remove screws from each end of cable groove, and detach cables from capstan (cable drum).

B. Install servo mounting

Special tools and equipment :-

| | |
|---|---|
| Rigging pin set | BAe 25-7Y15A |
| Tensiometer | Teleflex T5/2002/401/00 |

NOTE: Operations (1) and (2) are only applicable if new servo mounting is being fitted. Operations (3) and subsequent apply if the existing servo mounting is being refitted.

(1) Remove and discard ring, mounted on guard posts, over end of cable drum. Remove guard posts.

(2) Remove screws and lock washers from each end of cable groove.

(3) Fit cable ends into cable drum, and fit screws and lock washers at each end of the cable groove. Tighten screws and wire-lock. Wrap cables on cable drum as shown on Fig.201.

(4) Secure guard posts to servo mounting at positions shown on Fig.201. Position cable guard with cable exits located as shown on Fig.201, and secure to servo mounting with screws. Wire-lock screws in pairs.

NOTE: Screws securing cable guard fit into guard posts.

(5) Position servo mounting behind frame 5, pass cables through holes in frame 5, and fit cables into aileron pulley drum. Locate servo mounting on structure, and secure with bolts.

NOTE: Post Mod 251409, additional adjustment for cables is provided by packing pieces at servo-mounting. If it is found necessary to remove all three packing pieces to obtain adjustment, suitable packing washers are to be inserted between bolt heads and servo-unit.

(6) Secure aileron pulley drum guards with bolts.

NOTE: Ensure that the shim is refitted and that a clearance of 0.030 in. to 0.050 in. is obtained between circular guard and pulley drum as shown on Fig. 201. Adjust shim thickness as necessary.

(7) With aileron controls at neutral, insert rigging pin through aileron pulley drum and its mounting (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

...Aileron servo mounting - Maintenance practices continued

(8) Set tensiometer to suit 10 cwt cables, and position it midway between servo mounting and aileron pulley drum. Tension cables to 95 lb/100 lb by means of adjustment bolts in aileron pulley drum. After adjustment, tighten locknuts and wire-lock. Check that there are no fouls between autopilot cables and remainder of cables running from aileron pulley drum. Remove rigging pin from aileron pulley drum.

(9) Operate control column handwheel through full range allowed by aileron primary stops. Check servo mounting and associated cables for full and free movement.

(10) Secure right side inboard and outboard floor panels, and centre floor panel with bolts.

(11) Position gaiter mounting on floor, around control column, and secure to floor with bolts (see Chapter 27, CONTROL COLUMN).

(12) Secure access cover to floor, aft of control column, with bolts.

(13) Attach gaiter to column, locating pins in each side of column. Close zip, fit bolt through strap at top of gaiter and tab of zip; fit washer to bolt, and secure bolt with stiffnut. Secure bottom of gaiter mounting with bolts. Ensure that column movement is not impeded (see Chapter 27, CONTROL COLUMN).

(14) Secure seal ring to floor panels around rudder pedal adjustment unit with bolts (see Chapter 27, CONTROL COLUMN).

(15) Connect fork-end of cable of rudder pedal adjustment unit with shear pin; fit washer on shear pin, and secure with split pin.

(16) Secure panel to floor, between rudder pedals, with bolts.

(17) Secure fairing to flight compartment right side console.

(18) Secure cover to control pedestal.

(19) Fit equipment tray, connect electrical cables to components mounted on equipment tray, and connect pitot static pipes to component(s) on equipment tray. Tighten unions and wire-lock.

(20) Leak test pitot static system (see Chapter 34, PITOT/STATIC SYSTEM).

(21) Fit and secure inverter mounting with bolts. If relevant, fit and secure inverter(s); connect and secure electrical cables to inverter(s).

(22) Install aileron servo in servo mounting (see Chapter 34, AILERON SERVO UNIT).

(23) Restore electrical supplies to systems of which components mounted on equipment tray are a part (see Chapter 24, GENERAL), and functionally test these systems.

...Aileron servo mounting - Maintenance practices continued

(24) Restore electrical power supplies to systems of which inverter(s) are a part and functionally test these systems.

NOTE : Operation (24) is only applicable when the systems referred to in operation (23) do not include the inverter(s).

(25) Mate duct with duct which protrudes from fairing on flight compartment right side; fit distance tube between duct attachment brackets, and secure ducts together with bolt. Secure shroud over duct with Camloc fasteners, which fasten into floor and pilot's seat support structure.

(26) Secure duct and guard panel assembly to side of right pilot's seat support structure. Leak test pipes and ducting (Chapter 21).

(27) Functionally test aileron control system (see Chapter 27, AILERON AND AILERON TRIM CONTROL SYSTEMS).

* * *

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## RUDDER AND RUDDER TRIM CONTROL SYSTEMS - DESCRIPTION AND OPERATION

### 1. Rudder control system (Fig.1)

#### A. General

Movement of the rudder pedals is transmitted by connecting rods and a bell-crank to a pulley drum under the flight compartment. Cables connect the pulley drum to a quadrant at the base of the rudder torque tube. The rudder incorporates a geared tab and a trim tab. Both tabs give anti-servo action, the position of the trim (lower) tab is also controllable from the flight compartment. A spring strut is connected to the base of the rudder torque shaft to provide a centring force at the extreme travel. Adjustment of the rudder pedals, to suit leg reach, is facilitated by an operating lever and adjustment unit (see Fig.2).

#### B. Rudder stops

Primary stops are located at the rudder bottom hinge. A shim adjusted stop bolt on each side of the rudder contacts a fixed stop plate, and determines the range of movement. Secondary stops are located at each rudder pedals assembly; when the primary stops take effect, a clearance exists at the secondary stops.

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### 2. Rudder bias system (Fig.3 and 4)

#### A. Description

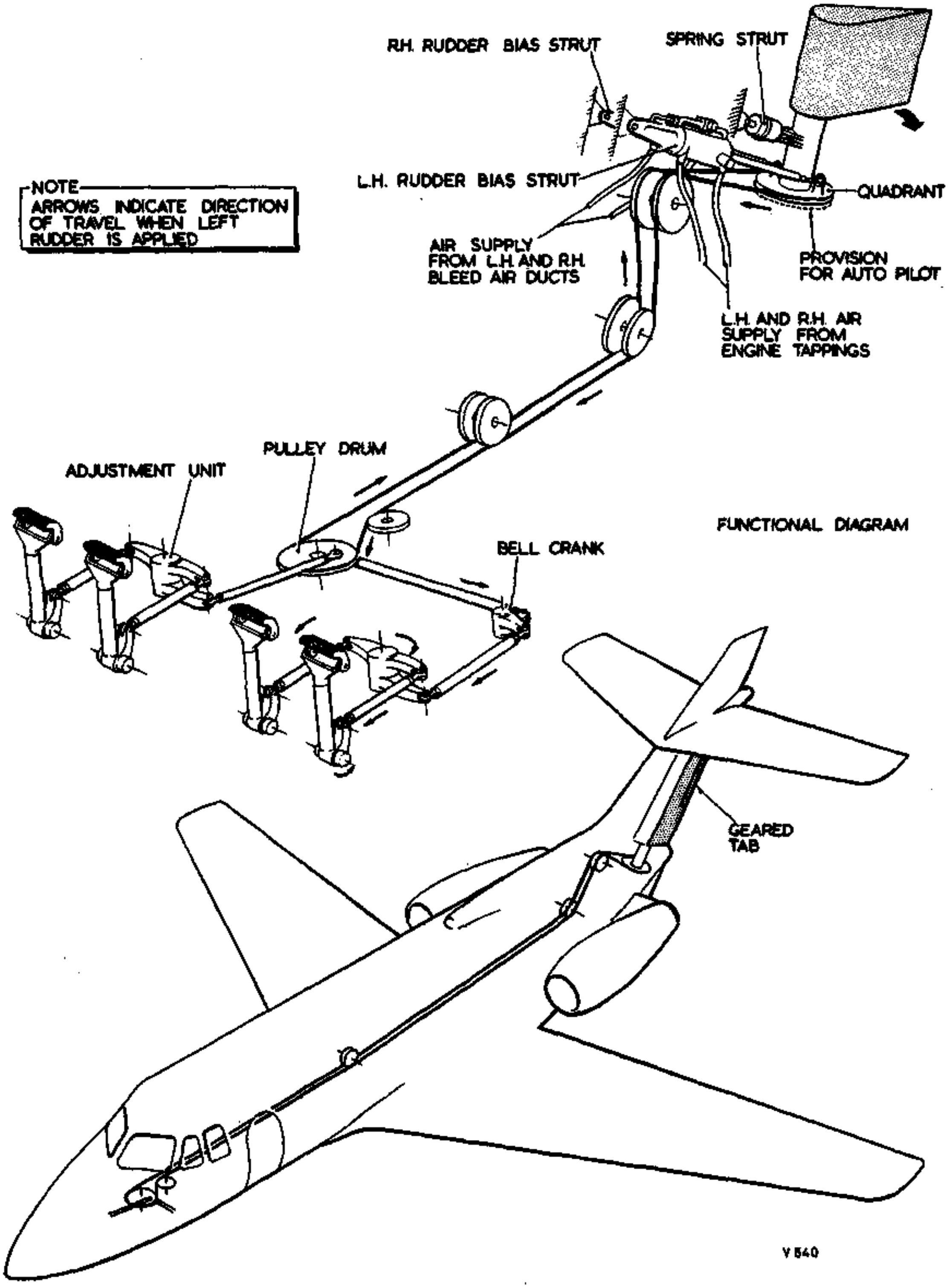
NOTE : Mods.252762 and 252829 introduce bias struts with restrictors in the pipe-connecting unions and with improved valve arrangements, respectively. It is permissible to have mixed installations of pre and post modification struts.

The rudder bias system is provided so that in the event of engine failure or malfunction, the resultant asymmetric thrust will be automatically counteracted by rudder movement.

The system is operated by air, derived from a tapping off each engine L.P. compressor and each air conditioning low pressure bleed air duct, and is connected to two pneumatic struts, each with an integral solenoid-operated valve. The left-hand strut is operated from the tapping from each engine, and the right-hand strut from the bleed air ducts from each engine. Each strut is attached to the fuselage and the rudder quadrant.

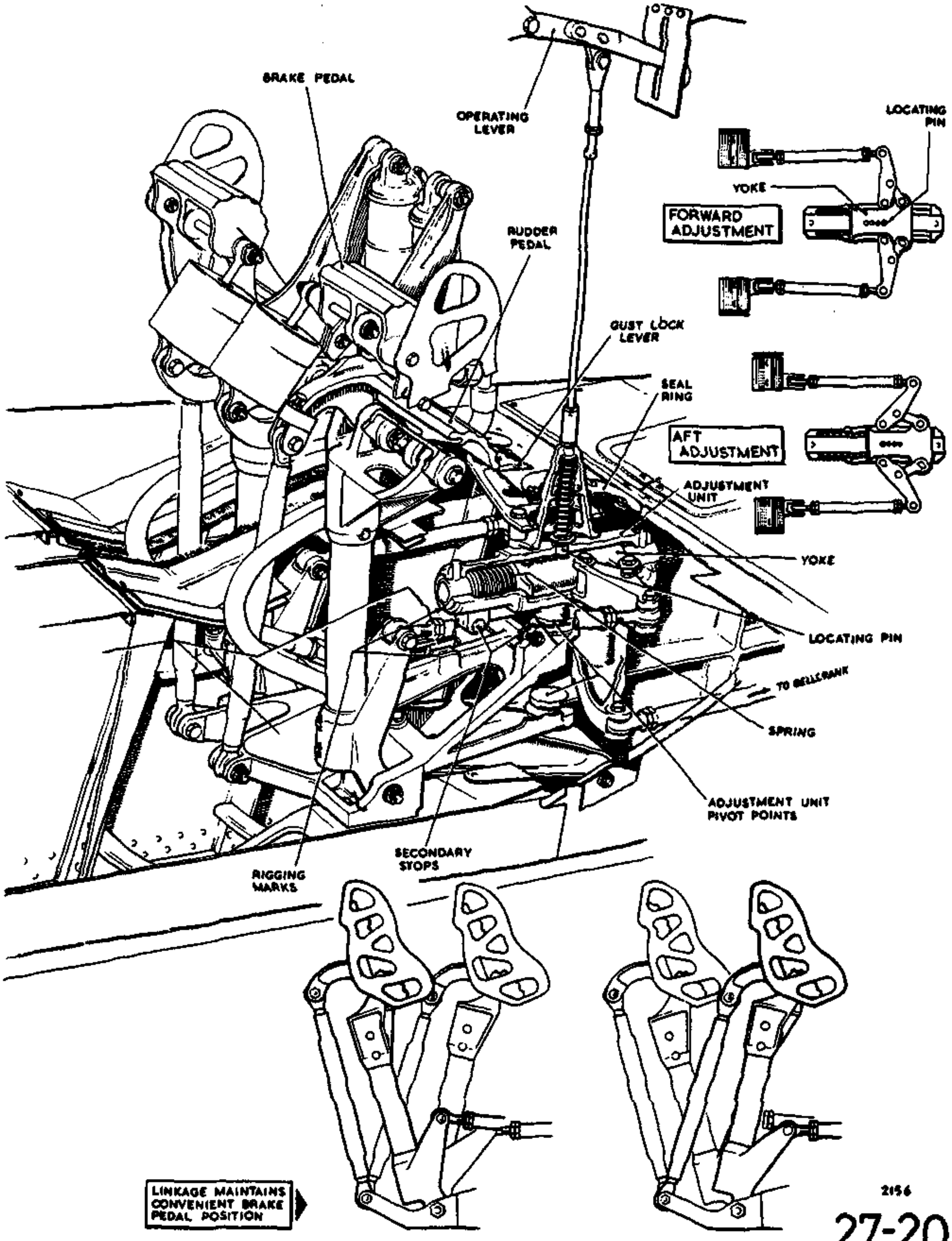
An electrical heater muff on each strut ensures that ice will not prevent operation of the strut and valve. Each muff has two elements with separate supplies controlled by the pitot head switches on roof panel CG; each switch supplies one element of each strut.

The solenoid valves, which connect the opposite sides of the strut pistons, and are normally closed, are each controlled by a RUDDER BIAS switch on the left-hand pedestal switch panel. Accidental operation of the switches is prevented by a guard on each switch, and a warning annunciator is fitted on the left-hand instrument panel CA, to indicate if any one switch is not in the ON position.

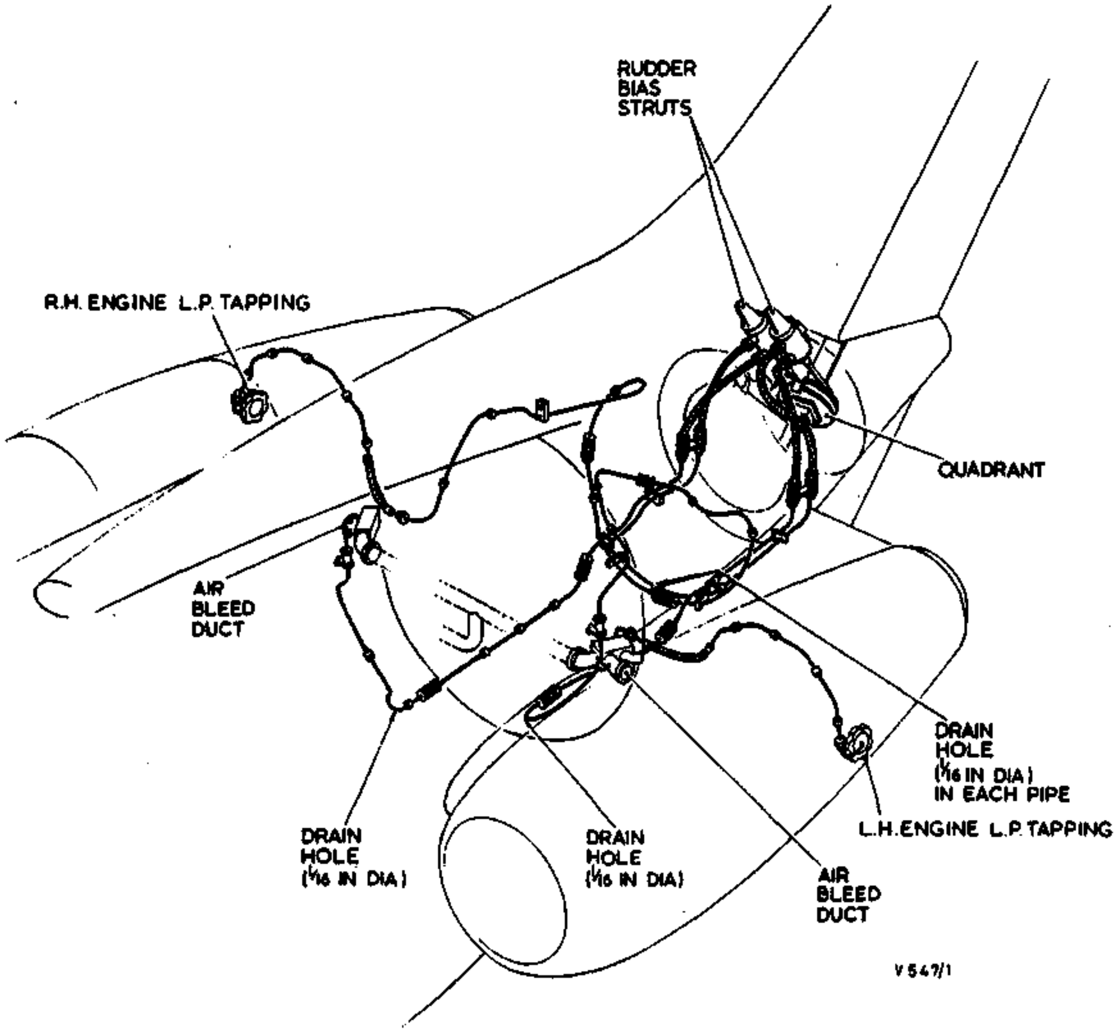


NOTE
ARROWS INDICATE DIRECTION OF TRAVEL WHEN LEFT RUDDER IS APPLIED

FUNCTIONAL DIAGRAM



Rudder pedal installation
Fig.2



Rudder bias pipelines
Fig.3

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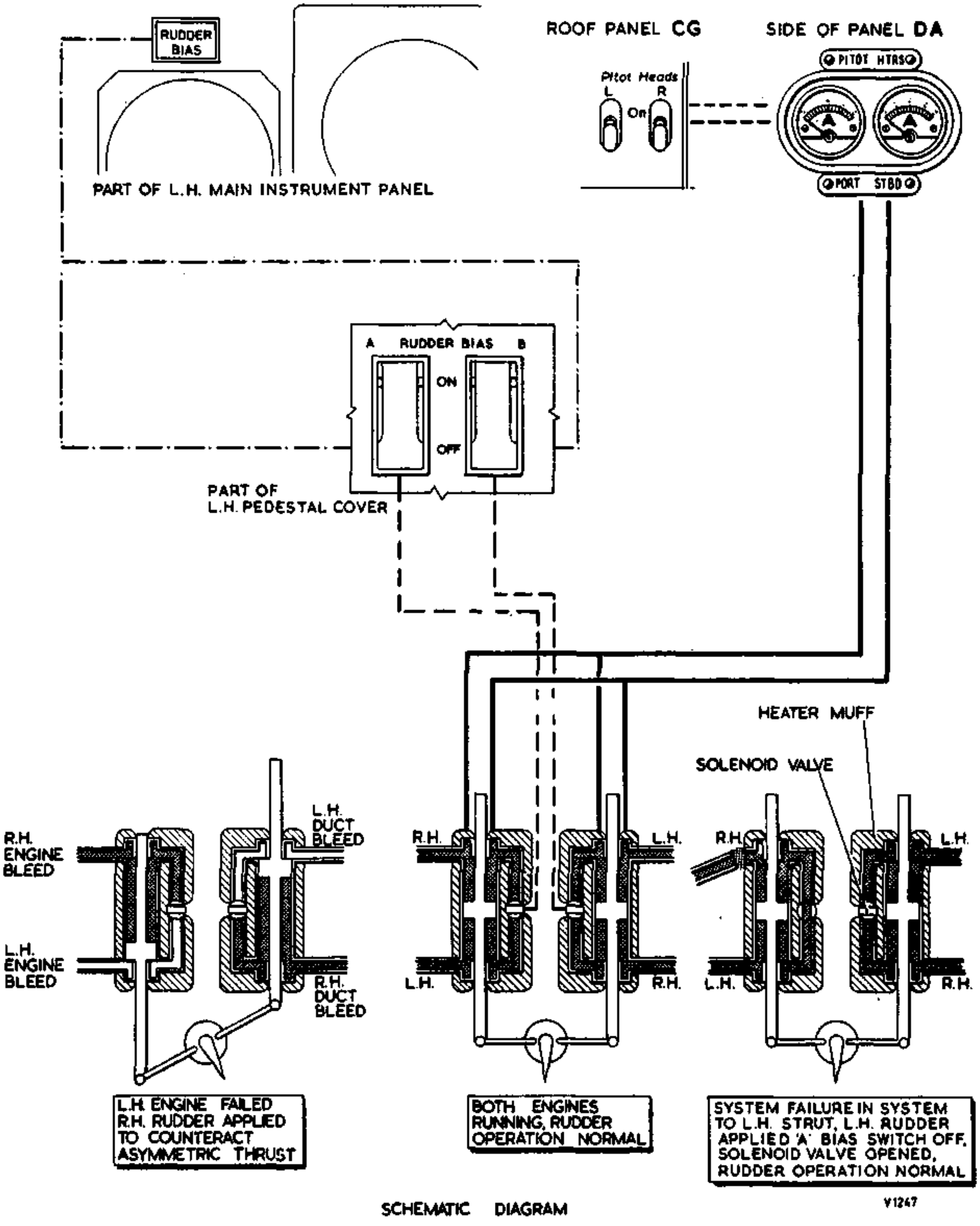


Rudder bias system diagram
Fig.4

B. Operation

With both engines operating at the same power, there is no pressure difference between opposite sides of the pistons, and rudder position is uninfluenced by the bias system. If one engine fails, a pressure difference occurs within the pneumatic struts and the resulting piston movement operates the rudder to counteract the asymmetric thrust.

If during normal operation of both engines, there is any significant difference in thrust between the engines, the rudder will be biased to compensate for this difference.

In the event of a leak in the system piping while both engines are running normally, the pressure on one side of one piston will drop; this will bias the rudder unnecessarily. To overcome this condition, the relevant RUDDER BIAS switch must be selected to open the solenoid valve, thus equalizing the pressure on opposite sides of the piston. Once a solenoid valve has been opened, the bias system is operated by one strut only.

3. Rudder trim control system (Fig.5)

A. General

A trim box in the control pedestal is connected by cables and chains to a sprocket mounted on the vertical stabilizer rear spar. A torque shaft connects the sprocket to a trim jack. The trim jack is a non-reversible screw type, with twin output fork-ends operated by a common drive. Two connecting rods pass through the rudder, linking the trim jack to a tab.

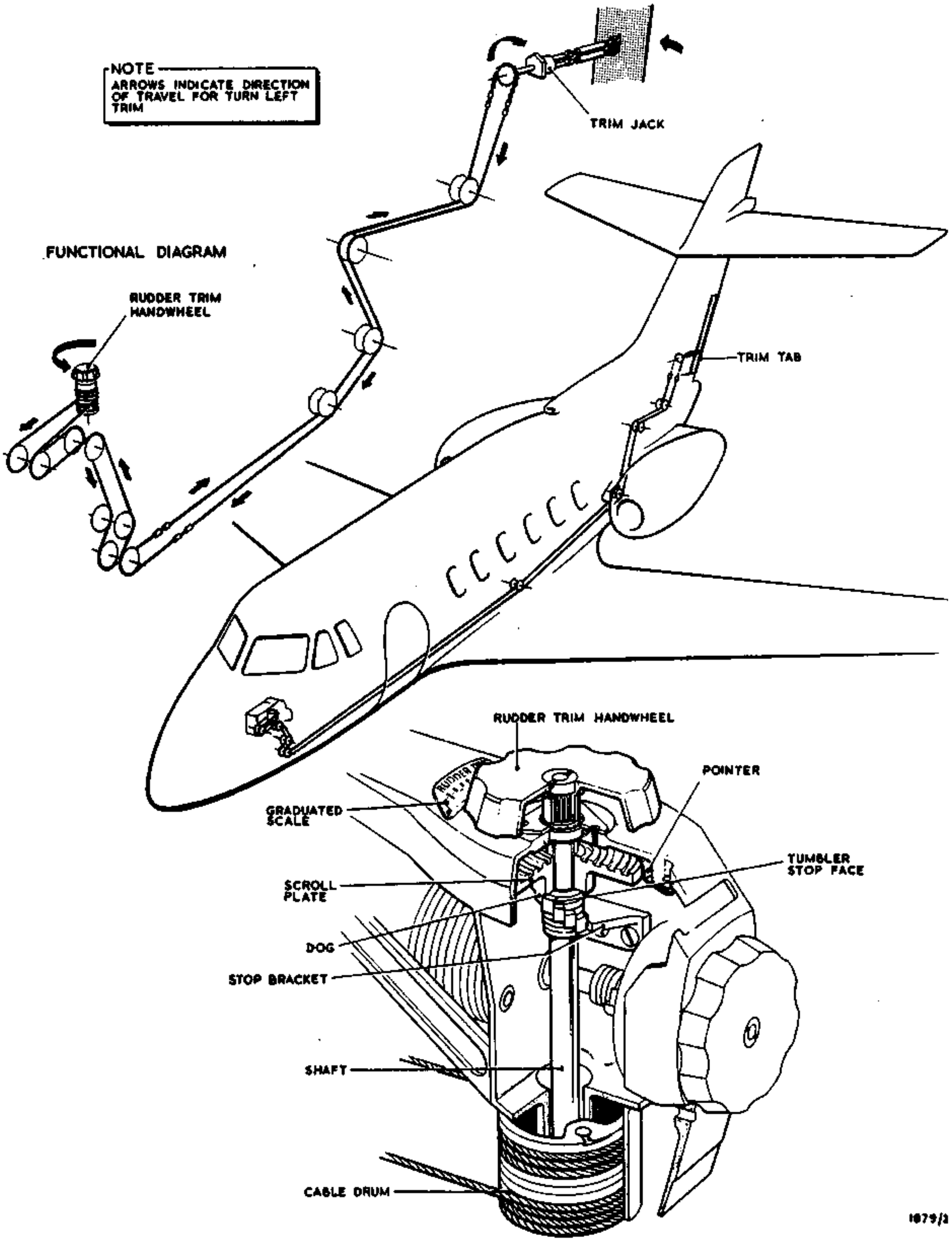
When the rudder trim control is at neutral, operation of the rudder moves the trim tab to give anti-servo action. This movement is caused by the relationship of the trim jack to the rudder hinge line.

B. Trim box

A rudder trim handwheel and a cable drum are splined to a shaft which rotates in the trim box; a scroll plate is pinned to the shaft. Five tumblers are free to rotate about the shaft; each tumbler embodies a stop face, which contacts the stop face of the adjacent tumbler. The first and fifth tumbler stop faces also contact a stop bracket and a dog on the scroll plate.

Rudder trim handwheel movement is restricted to 4.6 revolutions by the tumblers.

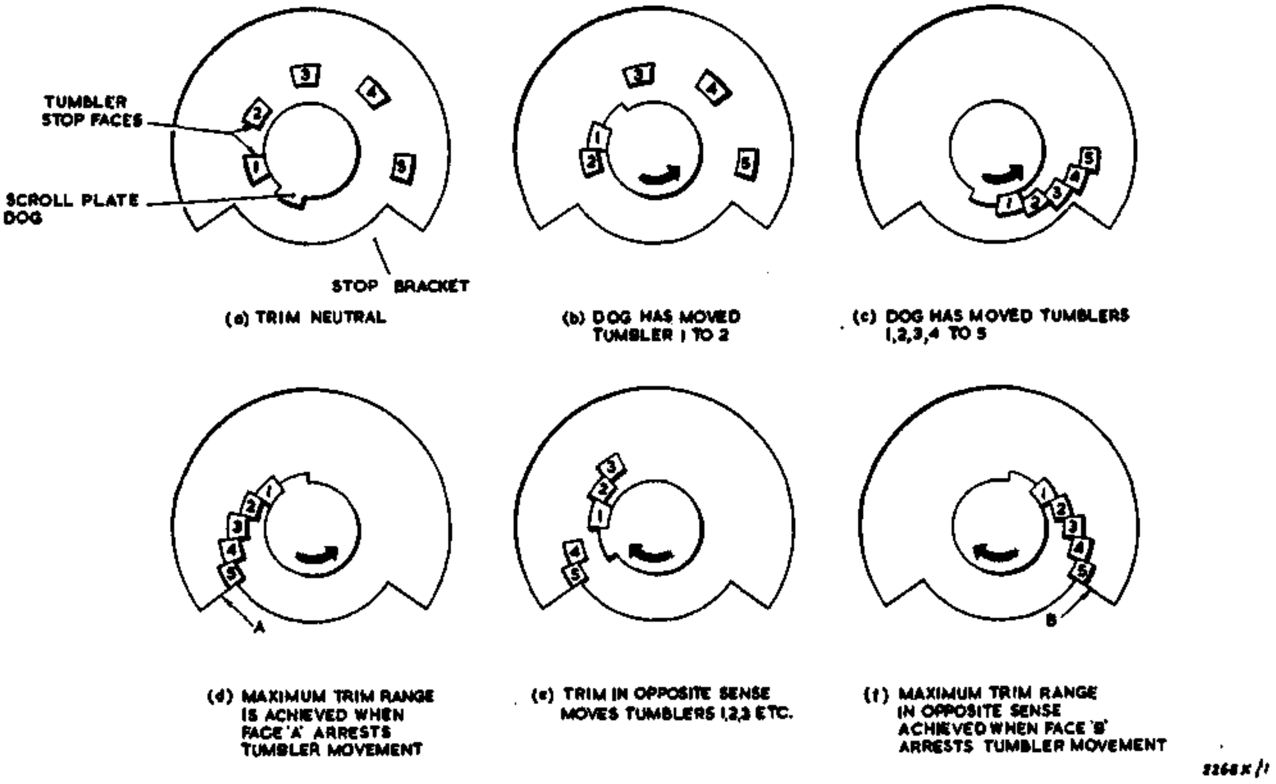
The scroll plate is helically grooved on its top face; a pointer, fitted with a pin which locates in this groove, indicates trim position on a label (graduated scale).



Rudder trim control system
Fig.5

## C. Operation

Rotation of the rudder trim handwheel turns the scroll plate, and the dog on the scroll plate contacts the stop face of the adjacent tumbler. Each successive revolution engages another tumbler. The schematic operation on Fig.5 (a) to (d) shows tumbler movement in one trim sense. Trim movement in the opposite sense (Fig.5 (e) and (f)) moves the scroll plate so that the opposite face of the dog contacts the other stop face of tumbler No.1.



(a) TRIM NEUTRAL

(b) DOG HAS MOVED TUMBLER 1 TO 2

(c) DOG HAS MOVED TUMBLERS 1,2,3,4 TO 5

(d) MAXIMUM TRIM RANGE IS ACHIEVED WHEN FACE 'A' ARRESTS TUMBLER MOVEMENT

(e) TRIM IN OPPOSITE SENSE MOVES TUMBLERS 1,2,3 ETC.

(f) MAXIMUM TRIM RANGE IN OPPOSITE SENSE ACHIEVED WHEN FACE 'B' ARRESTS TUMBLER MOVEMENT

Schematic operation of trim stops
Fig.6

## D. Rudder trim stops

The range of movement of the trim tab is limited solely by the stop faces of the tumblers in the trim box. There is no adjustment to the trim tab range of movement.

* * *

# RUDDER AND RUDDER TRIM CONTROL SYSTEMS - ADJUSTMENT/TEST

**WARNING: IF A PART OF THIS SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, A FULL EXAMINATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT DISTORTION, TOOLS, RAGS, OTHER LOOSE OBJECTS OR UNWANTED MATERIAL THAT COULD PREVENT THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM ARE NOT PRESENT, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE WORK AREA ARE CLEAN.**

**WARNING: IF A PART OF EITHER THE MAIN OR ANY ASSOCIATED SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, THAT PART OF THE SYSTEM WHICH HAS BEEN CHANGED SHALL BE GIVEN AN ADDED INSPECTION FOR CORRECTLY INSTALLED LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

**WARNING: WHEN WORKING ON THE FLIGHT CONTROL SYSTEMS, DISPLAY WARNING NOTICES IN THE FLIGHT COMPARTMENT TO PREVENT OPERATION OF THE CONTROLS.**

**WARNING: MAKE SURE THAT THE FLYING CONTROL SURFACE RANGE OF TRAVEL IS CLEAR OF ANY OBSTRUCTIONS**

*NOTE: For routine lubrication data refer to the Maintenance Schedule.*

## 1. Rig rudder control system

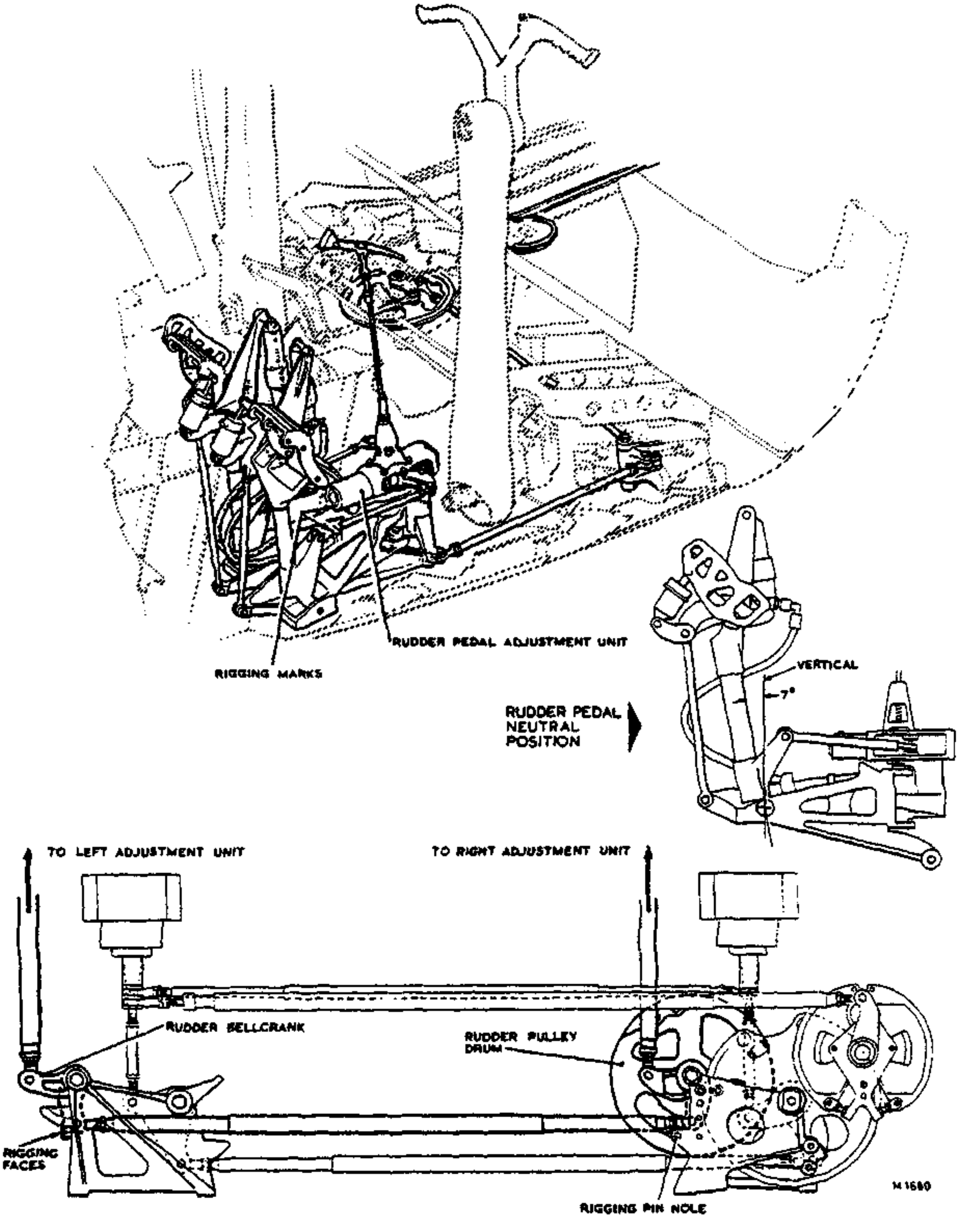
| Equipment/Material | Part/Item No. |
|---|---|
| Rigging pin set | 25Y493AB |
| Rudder movement checking gauge | 25Y75A/B |
| Rudder tabs movement checking gauge | 25Y1093A/B |
| Tensiometer | Teleflex T5/2002/401/00 |
| Inclinometer | Local supply |

### A. Rig rudder control system forward of pulley drum *(Figure 501)*

(1) Level the airplane (Chapter 8, LEVELLING AND WEIGHING).

(2) Install rigging pin through rudder pulley drum and its mounting.

(3) Make sure that the rigging surfaces on the rudder bell-crank and its mounting are aligned. If necessary, adjust the connecting rod between the bell-crank and the rudder pulley drum to align the rigging surfaces. Make sure that the rod ends are in safety, tighten the locknuts, and lockwire.



Rudder controls in forward fuselage
*Figure 501*

(4) Make sure that the white painted rigging marks on the mounting and on the forward end of the left adjustment unit are aligned. If necessary, adjust the connecting rod between the integral lever of the left adjustment unit and the rudder bell-crank to align the rigging marks. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

(5) Adjust the left rudder pedals to the fully forward position, that is, with the locating pin in the aft hole in the yoke. Use an inclinometer to check that the rudder pedals are at the neutral position. If necessary, adjust the connecting rod between the left and right rudder pedal and the left adjustment unit to get a neutral position. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

(6) Make sure that the white painted rigging marks on the mounting and on the forward end of the right adjustment unit are aligned. If necessary, adjust the connecting rod between the integral lever of the right adjustment unit and the rudder pulley drum to align the rigging marks. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

(7) Do paragraph (5) again for the right rudder pedal assembly.

### B. Rig rudder control system aft of pulley drum *(Figure 502 and Figure 503)*

(1) Adjust the turnbuckles 9B-9B and 10B-10B until they are in safety. Tighten the locknuts and lockwire.

(2) Insert the rigging pin through quadrant and cable guard plate. If rigging pin cannot be inserted, adjust turnbuckles connecting cable ends 9C-9C and 10C-10C. Set the tensiometer to suit 15 cwt cables and position as shown *(Figure 502)*. Make sure the cable tensions are between 70 and 80 lbs. Do a check of the turnbuckles for safety, tighten the locknuts and lockwire.

(3) Make sure that the geared tab is at the neutral position. If necessary, adjust the rudder geared tab to get the neutral position (Paragraph 2.A.).

(4) Make sure that the spring strut is at the neutral position, that is, the aft face of the piston is aligned with the forward edge of the inspection hole. If necessary, adjust the spring strut to get the neutral position. Make sure that the eye end is in safety, tighten the locknut and lockwire; make sure that the lockwire will not foul the spring strut during operation.

*NOTE: Operate the rudder by hand to extend the spring strut for access to lockwire and to make sure that the eye end is in safety.*

(5) Remove the rigging pin from rudder pulley drum and quadrant.

(6) Do a check of the rudder range of movement (Paragraph 9.C.)

(7) Do a functional test on the rudder control system (Paragraph 5.A.).

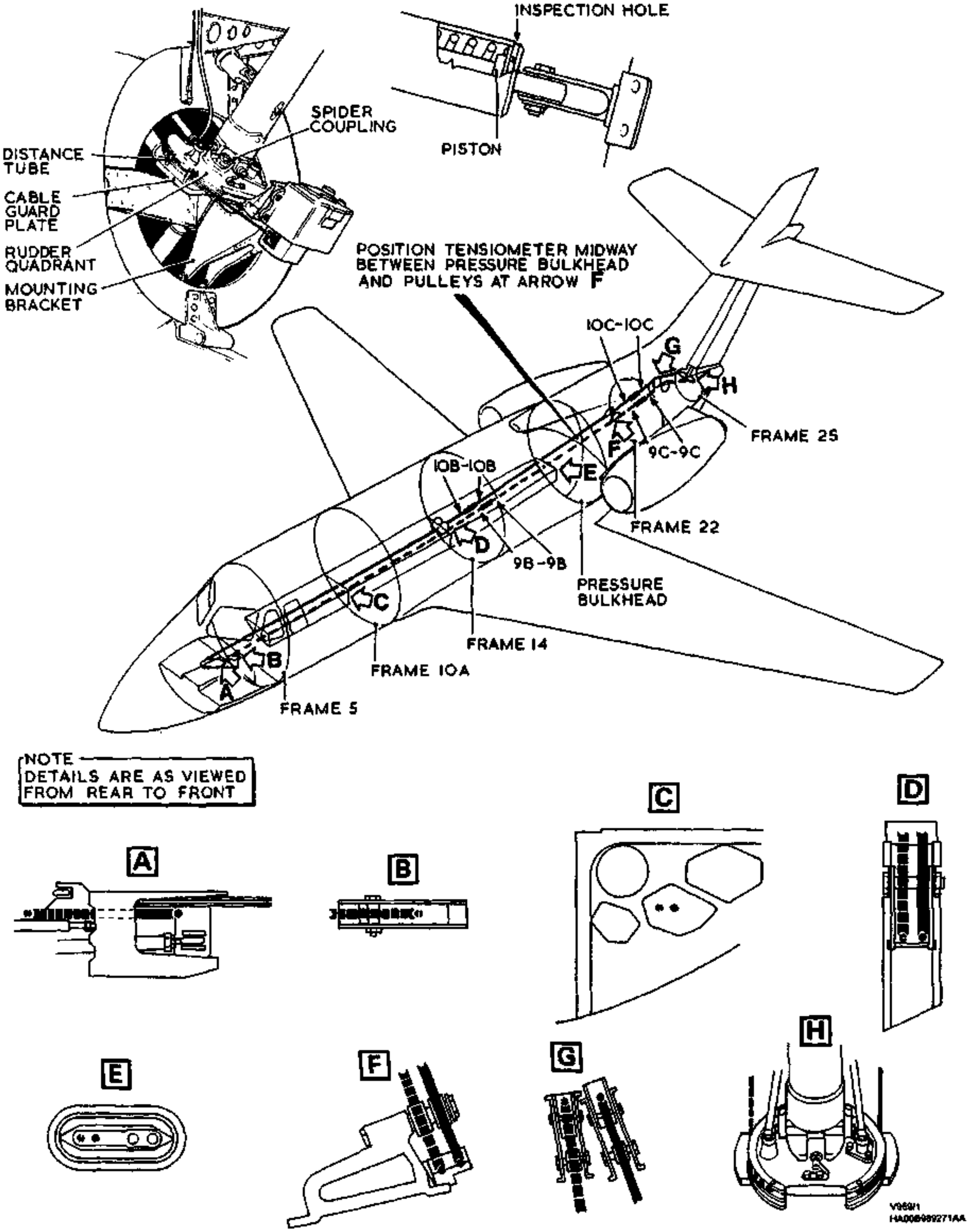
## 2. Adjust rudder geared tab to neutral position

### A. Procedure *(Figure 503)*

(1) Disconnect the rods from the geared tab.

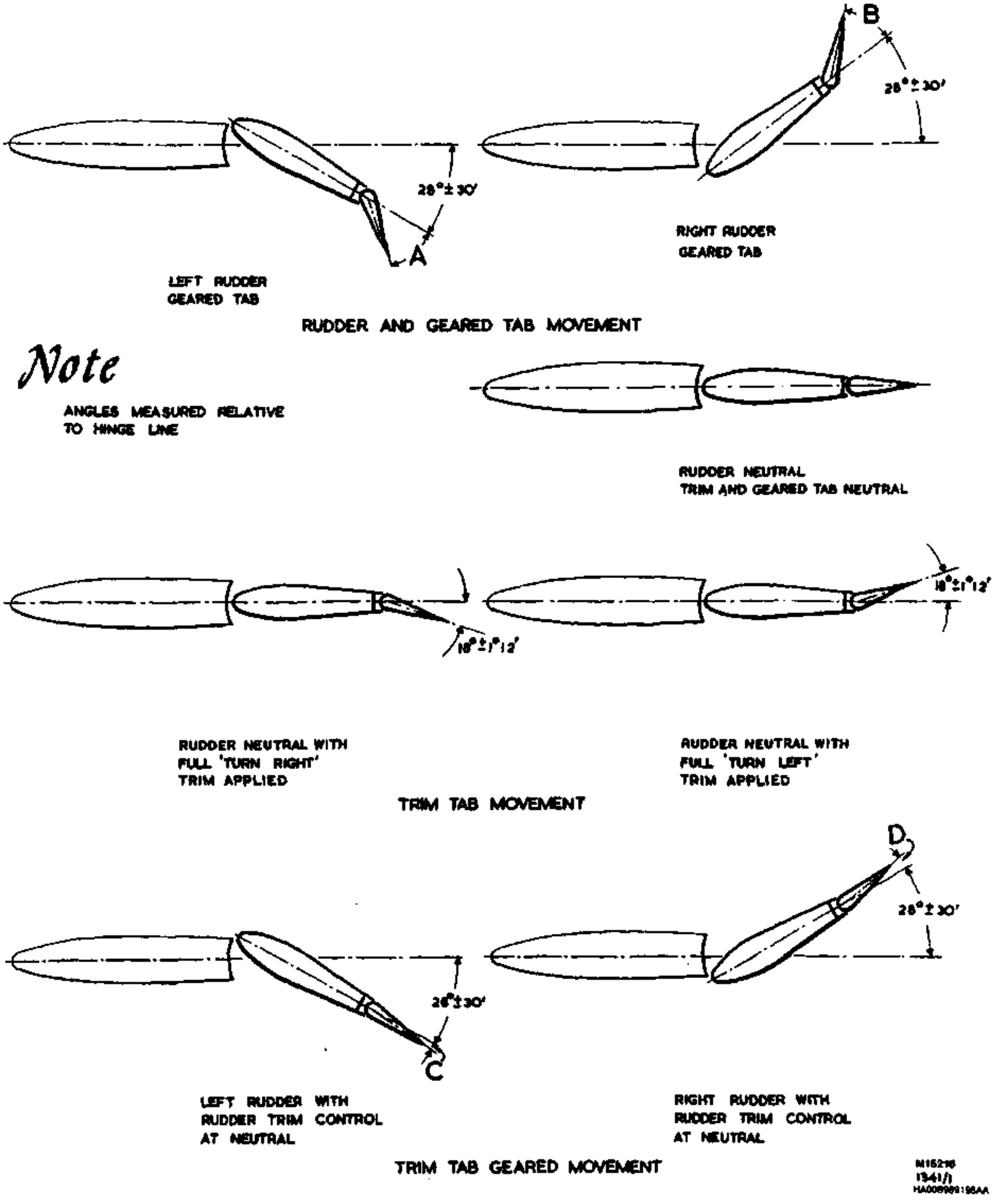
(2) Do a check and record the rudder control circuit static friction (Paragraph 9.F.).

*NOTE: In paragraph (2) make sure that the geared tab connecting rods do not catch the adjacent structure.*



NOTE
DETAILS ARE AS VIEWED FROM REAR TO FRONT

Rudder control system rigging
*Figure 502*



Rudder and rudder tab-movements
*Figure 503*

(3) Secure the connecting rods to the geared tab with bolts, washers and nuts.

(4) Adjust the geared tab connecting rods together at the same time to set the tab to the neutral position. The adjusted length of one rod must not tend to compress or tension the other rod. Do a check of the free movement (backlash) of the rudder geared tab (Paragraph 9.G.).

*NOTE: Geared tab neutral position can be found with a checking gauge (Paragraph 9.E.).*

(5) Do a check of the rudder control circuit static friction (Paragraph 9.F.). If there is an increase in the static friction from that measured in paragraph (2), the increase must be removed such that there is no tendency for one rod to compress or tension the other rod.

(6) Make sure that the aft ends of both geared tab connecting rods are in safety, tighten the locknuts and lockwire.

## 3. Rig rudder trim control system *(Figure 503, Figure 504 and Figure 505)*

### A. Procedure

(1) Operate the rudder trim handwheel to set the pointer at neutral position. Make sure that the cable drum is wrapped with three and a half turns of each cable, the turns arranged at opposite ends of the cable drum. If not, remove the cable guard from around the cable drum, and wrap three and a half turns of each cable onto opposite ends of the cable drum. Install the cable guard and secure with two bolts.

(2) Adjust the turnbuckles connecting cable ends 15B-15B and 16B-16B until they are in safety. Tighten the locknuts and lockwire.

(3) In the rear equipment bay: make sure that the rudder trim chain is equally arranged about the sprocket mounted on the vertical stabilizer rear spar. If necessary, adjust the turnbuckles connecting cable ends 15C-15C and 16C-16C to correct arrangement of the chain.

(4) Set the tensiometer for 5 cwt cables and position as shown. Tension cables to between 25lb. and 30lb. to maintain the chain configuration in paragraph (3). Do a check of the turnbuckles for safety, tighten the locknuts and lockwire.

(5) Make sure the trim jack is at neutral position, that is, the corners of nuts on the fork-ends are aligned with the rigging face.

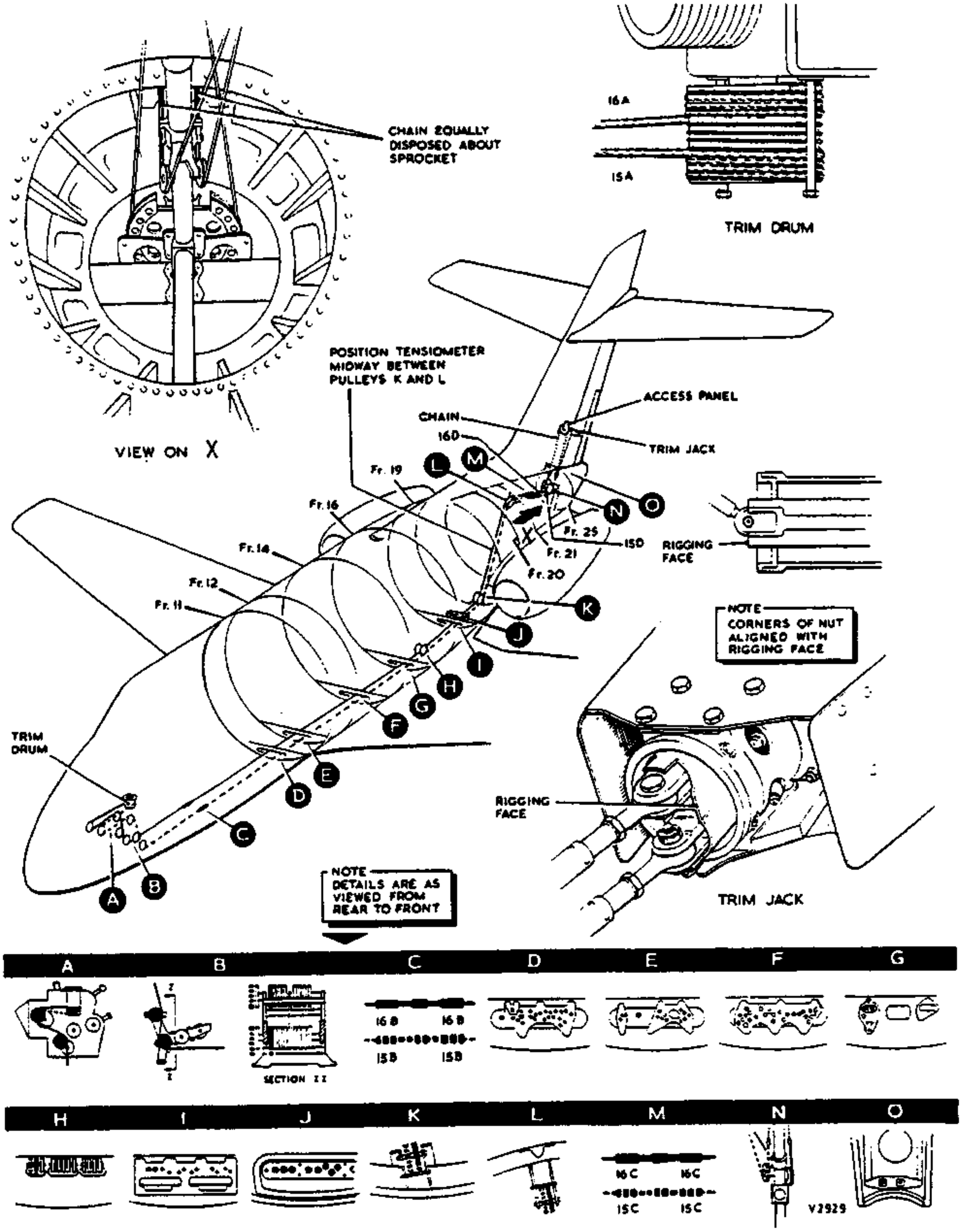
*NOTE: If the trim jack is not at the neutral position, it must be removed and reinstalled to allow the relationship of the trim jack fork-end to the chain configuration to be corrected (RUDDER TRIM JACK).*

(6) Install a rigging pin through the rigging pin holes in the rudder quadrant and cable guard plate. Make sure that the trim tab is at the neutral position. If necessary, adjust the rudder trim tab to neutral position (Paragraph 4.A.).

(7) Remove the rigging pin from the rudder quadrant.

(8) Do a check of the rudder trim tab range of movement (Paragraph 9.D.).

(9) Functionally test the rudder trim control system (Paragraph 8.A.).



Rudder trim control system rigging

*Figure 504*

## 4. Adjust rudder trim tab to neutral position

### A. Procedure *(Figure 503)*

(1) Disconnect the rods from the trim tab.

*NOTE: In paragraphs (2) and (3) make sure that the trim tab connecting rods do not catch adjacent structures.*

(2) Do a check and record the rudder control circuit static friction (Paragraph 9.F.).

(3) Make sure that the force required to operate the rudder trim handwheel from stop to stop is not too much.

(4) Attach the connecting rods to the trim tabs with bolts, washers and nuts.

(5) Adjust the trim tab connecting rods together, to set the tab to the neutral position. The adjusted length of one rod must not tend to compress or tension the other rod. Drain holes in the connecting rods must be positioned to be within 25° of the rod vertical center line. Do a check of the free movement (backlash) of the rudder trim tab (Paragraph 9.G.).

*NOTE: The trim tab neutral position can be found with a checking gauge (Paragraph 9.D.).*

(6) Do a check of the rudder control circuit static friction (Paragraph 9.F.). If there is any increase in the static friction from that recorded in paragraph (2), the increase must be released such that there is no tendency for one trim tab connecting rod to compress or tension the other rod. Similarly, reduce any increase in force required to operate the rudder trim handwheel.

(7) Make sure that the ends of both trim tab connecting rods are in safety, tighten the locknuts and lockwire.

## 5. Do a functional test of the rudder control system

### A. Procedure

(1) Set the rudder pedals to neutral and install the rudder gust lock through the hole in the floor and rudder gust lock lever. Make sure that the rudder trailing edge aligns with the tail cone fillet.

(2) Remove the rudder gust lock and stow on shroud forward of the co-pilot's seat mounting.

(3) Operate the rudder pedals through their full range; make sure that the rudder moves in the correct sense, and that the range of movement is limited by the primary stops. Make sure that there is initial free movement each side of neutral, which is succeeded by a gradually increasing load until the primary stops are contacted.

(4) Operate the left and right rudder pedal assemblies through full fore-and-aft adjustment. Make sure that at full fore-and-aft adjustment the rudder pedals are operated through full range as specified in paragraph (3). Make sure that each rudder pedal assembly can be adjusted to four positions. Make sure that the cables connected to the locating pins of the adjustment unit do not prevent locating pin movement.

(5) Apply one full TURN RIGHT trim with the rudder trim handwheel, and do again paragraph (3).

(6) Apply one full TURN LEFT trim with the rudder trim handwheel, and do again paragraph (3).

## 6. Do a functional test of rudder bias system

### A. Procedure

(1) Start both engines (Chapter 71, GENERAL) and energize 28 volts d.c. busbars.

(2) With both engines at idle, set the RUDDER BIAS switches to OFF. Make sure that the warning light is on.

(3) Increase No.2 engine to 70% $N_1$ and make sure that there is no movement of the rudder pedals.

(4) Set the RUDDER BIAS switch A to ON, and make sure that the warning light remains on and each right-hand rudder pedal moves forward, and that an appreciable force is required to oppose this movement.

(5) Set the RUDDER BIAS switch A to OFF, and make sure that the rudder can be operated normally and the force of operation is very small.

(6) Set the RUDDER BIAS switch B to ON, and do again paragraph (4).

(7) Apply force to balance the pedals. Set the RUDDER BIAS switch A to ON, and make sure that the warning light goes out and the force required to balance the pedals increases.

(8) Increase No.1 engine to 70% $N_1$, and with pedals in neutral position, make sure that the pedals do not creep from the neutral position.

(9) Reduce No.2 engine to idle, and check that left-hand pedal moves forward.

(10) Reduce No.1 engine to idle, and with the pedals in neutral position, make sure that the pedals do not creep from the neutral position.

(11) Stop both engines (Chapter 71 GENERAL).

## 7. Do a functionally test of rudder bias strut heater muff

### A. Procedure:

| Equipment/Material | Part/Item No |
|---|---|
| Multimeter | Local supply |

(1) Energize d.c. busbars (Chapter 24, GENERAL).

(2) On panel DA/E, open circuit breaker RUDDER BIAS HEATER - LH (grid ref. B2). Open panel and disconnect cable from terminal 2 of circuit breaker B14.

(3) Connect the multimeter, set to an applicable d.c. amps range, between terminal 2 of the circuit breaker (+ve) and the end of disconnected cable (-ve).

(4) Close the circuit breaker, make sure the multimeter indicates zero.

**CAUTION: THE PITOT HEADS SWITCH MUST NOT STAY ON FOR MORE THAN 5 MINUTES IN STILL AIR.**

(5) Set the PITOT HEADS LH switch to ON, and check that multimeter indicates 1.6 amp approximately.

*NOTE: If multimeter reading is approximately 0.8 amp, one heater muff is defective; make sure by hand which is the defective muff.*

(6) Set the PITOT HEADS switch to OFF.

(7) Open the RUDDER BIAS HEATER LH circuit breaker. Disconnect the multimeter and connect the cable to terminal 2.

(8) Do paragraphs (2) to (7) again on right-hand circuit, using circuit breaker RUDDER BIAS HEATER - RH (grid ref. B3) terminal 2 of circuit breaker B15 and PITOT HEADS switch R.

(9) Close circuit breakers and de-energize the d.c. busbars.

## 8. Do a functional test of rudder trim control system

### A. Procedure

(1) Operate the rudder trim handwheel over its full range from stop to stop; make sure that the pointer moves over the full scale, and that the pointer and tab move in the correct sense.

(2) Operate the rudder trim control to set the pointer at neutral position, and operate the rudder pedals to align the geared (upper) and trim tab trailing edges; make sure that the trim tab trailing edge also aligns with tail cone fillet.

(3) Operate the rudder pedals to apply full left rudder, and do a check of the rudder trim handwheel for full and free operation between stops.

(4) Operate the rudder pedals to apply full right rudder, do a check of the rudder trim handwheel for full and free operation between stops.

## 9. Rigging, range of movement, friction and bias switch guard checks

### A. Examine rigging of rudder control system *(Figure 501, Figure 502 and Figure 503)*

(1) Level the airplane (Chapter 8, LEVELLING AND WEIGHING).

(2) Set the rudder controls to neutral. Insert a rigging pin through the rudder pulley drum and its mounting *(Figure 501)*. Make sure that the rigging surfaces on the rudder bell-crank and its mounting are aligned.

(3) Make sure that the white painted rigging marks on the mounting and the forward end of the left adjustment unit are aligned.

(4) Adjust the left rudder pedal assembly to the fully forward position, that is, with the locating pin in aft hole in the yoke. Use an inclinometer to make sure that the rudder pedals are at the neutral position *(Figure 501)*.

(5) Do paragraph (3) and (4) again for the right rudder pedal assembly.

(6) Insert the rigging pin through the quadrant and cable guard plate.

(7) Set the tensiometer for 15 cwt cables, and at the position shown *(Figure 502)*, make sure that the tension in each cable is between 70 lb. and 80 lb.

(8) Make sure that the geared tab is at neutral position *(Figure 503)*.

*NOTE: The geared tab neutral position can be determined with a checking gauge (Paragraph C.).*

(9) Make sure that the spring strut is at neutral position, that is, the aft face of the piston is aligned with the forward edge of the inspection hole *(Figure 502)*.

(10) Remove the rigging pins from the pulley drum and quadrant.

B. **Do a check on the rigging of rudder trim control system** *(Figure 502, Figure 503 and Figure 504)*

(1) Operate the rudder trim handwheel to set the pointer at neutral. Make sure that the cable drum is wrapped with three and a half turns of each cable, the turns arranged at opposite ends of the drum.

(2) In the rear equipment bay, make sure that the rudder trim chain is equally configured around the sprocket mounted on the vertical stabilizer rear spar.

(3) Make sure that the trim jack is at neutral position, that is, the corners of the nuts on the fork-ends are aligned with the rigging surface.

(4) Insert a rigging pin through the rigging pin holes in the quadrant and cable guard plate. Make sure that trim tab is at neutral position.

*NOTE: The trim tab neutral position can be found with a checking gauge (Paragraph D.).*

(5) Remove the rigging pin from the quadrant.

C. **Do a check of rudder range of movement** *(Figure 503)*

*NOTE:* A procedure for checking geared tab range of movement with a checking gauge is given in paragraph E.

(1) Set the rudder to the neutral position and install a rigging pin through the rigging hole in the rudder quadrant and cable guard plate.

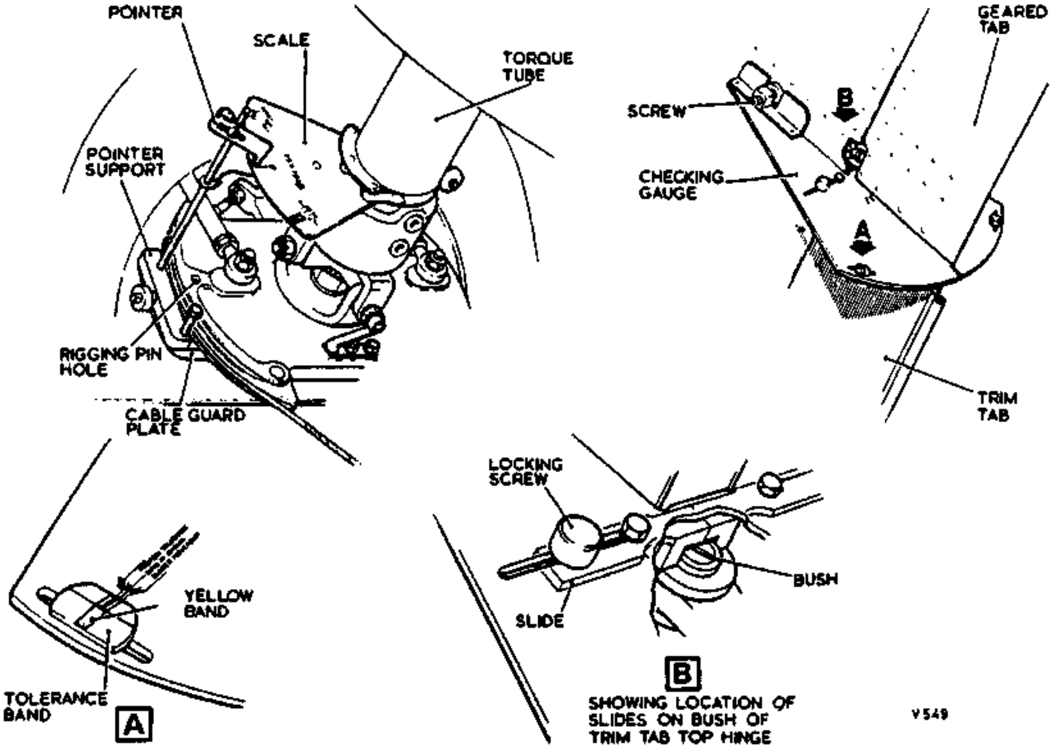
(2) Clamp the pointer support of gauge 25Y75A/B to the cable guard plate; loosely assemble the scale to the torque tube and the pointer to its support. Align the pointer with the scale neutral mark, and secure the scale and pointer.

(3) Operate the rudder trim handwheel to set the tab at full left travel.

(4) Loosen the locking screws of the checking gauge 25Y1093A/B, and pull the slides to the outer edge of the checking gauge.

(5) With the surface engraved TOP uppermost, install the checking gauge between the trim and geared tab. Push the checking gauge forward until it locates on the rudder profile. Lightly clamp the screw on the rudder to attach the checking gauge.

(6) Push one slide in through the gap between the tab and rudder; make sure that the slide locates on the bush of the top hinge of the trim tab. Tighten the locking screw to secure the slide.



Rudder and rudder tabs movement checking gauge installation
*Figure 505*

(7) Operate the rudder trim handwheel to set the tab at full right travel. Push the remaining slide in through the gap between the tab and rudder; make sure that the slide locates on the bush of the top hinge of the trim tab. Tighten the locking screw to tighten the slide.

(8) Make sure that the geared tab trailing edge is aligned with the engraved mark on the center line of the checking gauge. Remove the rigging pin from the rudder quadrant.

(9) Operate the rudder pedals through their full range. Make sure that when the rudder movement is limited by the primary stops, the pointer shows that the rudder movement is within the limits on *Figure 503.* Record the actual rudder movement and values of angles A and B for the geared tab.

*NOTE: It is not anticipated that the primary stops will require adjustment but, should this be necessary, adjust them as necessary (RUDDER).*

(10) Make sure that the clearance at the rudder secondary stops, below the rudder pedal adjustment unit is a minimum of 0.15in., when the rudder is at full deflection and only lightly touching the primary stops. Adjust the shim washers under the stop-pads as necessary; secure the stop-pads with cotter pins.

(11) With the information recorded in paragraph (9), do a check of the geared tab movement to formula:

$$\frac{A + B}{\text{total rudder movement}} = 1.48 \begin{matrix} +0.06 \\ -0.04 \end{matrix}$$

(12) Remove the tab checking gauge as follows:

- Loosen the thumb screws, securing the slides of the checking gauge.
- Operate the rudder trim handwheel to the extremes of travel and pull the slides clear when the trim tab is at the convenient extreme.
- Release the screw, and remove the checking gauge from the airplane.

(13) Release the pointer support and scale and remove the rudder checking gauge.

D. **Do a check of rudder trim tab neutral position and range of movement** *(Figure 503 and Figure 505)*

*NOTE:* The rudder range of movement must be within limits (Paragraph C.).

(1) Set the rudder to neutral position and install a rigging pin through the rigging holes in the rudder quadrant and cable guard plate.

(2) Install the trim tab checking gauge 25Y1093A/B and rudder checking gauge 25Y75A/B (Paragraph C.).

(3) Operate the rudder trim handwheel to set the pointer at neutral on the graduated scale. Make sure that the rudder trim tab trailing edge is aligned with the engraved mark on the center line of the checking gauge.

(4) With the rudder neutral, operate the rudder trim handwheel over its full range between stops, and make sure that the trim tab trailing edge lies within the white band of the checking gauge. Remove the rigging pin from the rudder quadrant.

(5) With the rudder trim control at neutral, operate the rudder over its full range allowed by the primary stops. Record the actual rudder movement, and values of angles C and D for the trim tab.

(6) From the data recorded in paragraph (5), make sure the trim tab geared movement is to the formula:

$$\frac{C + D}{\text{total rudder movement}} = 0.61 \pm 0.03$$

(7) Remove the tab checking gauge as follows:

- Loosen the thumb screws, which attach the slides of the checking gauge.
- Operate the rudder trim handwheel to the limits of travel and pull the slides clear when the trim tab is at the end limit.
- Release the screw, and remove the checking gauge from the airplane.

(8) Release the pointer support and scale and remove the rudder checking gauge.

### E. Do a check of rudder geared tab neutral position and range of movement *(Figures 503 and 505)*

*NOTE:* The rudder range of movement must be within limits given in paragraph C. A record of the actual rudder movement must be available.

(1) Set the rudder to neutral position, install a rigging pin through the rigging holes in the rudder quadrant and cable guard plate.

(2) Adjust tolerance bands to agree with actual rudder movement, and secure with integral hand nut.

(3) Make sure that the geared tab trailing edge is aligned with the engraved mark on the center line of the checking gauge. Remove the rigging pin from the rudder quadrant.

(4) Operate the rudder pedals through their full range. Make sure that when the rudder movement is limited by the primary stops, the geared tab trailing edge lies within the yellow band.

### F. Do a check of rudder control circuit static friction *(Figure 506)*

(1) Do this check with the circuit rigged, including the bias strut, rudder and tabs. The flight compartment floors must be removed to do this check.

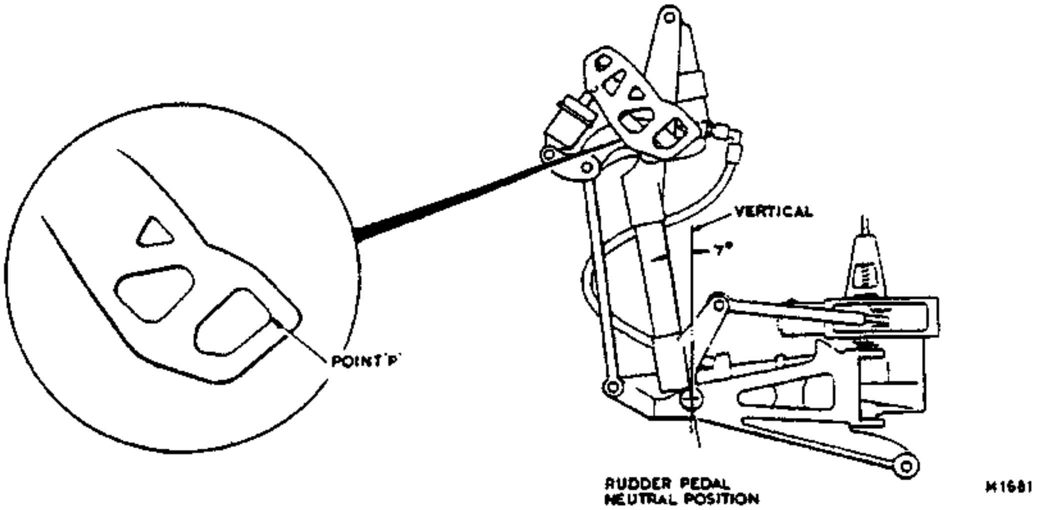
(2) Adjust the rudder pedals to the first position from fully aft.

(3) Attach a spring balance to measure the load required to operate each rudder pedal in turn; apply load horizontally at point P, as shown.

(4) Record the loads required to operate each rudder pedal from neutral, and for full rudder movement between stops. The maximum loads for a satisfactory control circuit are as follows:

- 10 lb break-out from neutral.
- 61 lb at full rudder travel.

*NOTE: Make sure that the rudder does not contact the primary stops when you do a check of the load at full travel.*



Rudder control circuit static friction
*Figure 506*

**G. Do a check of free movement of rudder and rudder tabs**

(1) Make sure that no movement of the quadrant occurs while the free movement of the rudder is being measured.

(2) Set up a dial test indicator to measure the rudder movement in a horizontal plane. Position the dial test indicator contact point on the head of the lower bolt of the trim tab bottom hinge. The maximum permissible free movement is 0.12 in.

(3) Make sure that no pivotal movement of the rudder occurs while the free movement (backlash) of the trim and geared tabs is being measured.

*NOTE: You must do the following paragraph to the rudder geared tab and the rudder trim tab.*

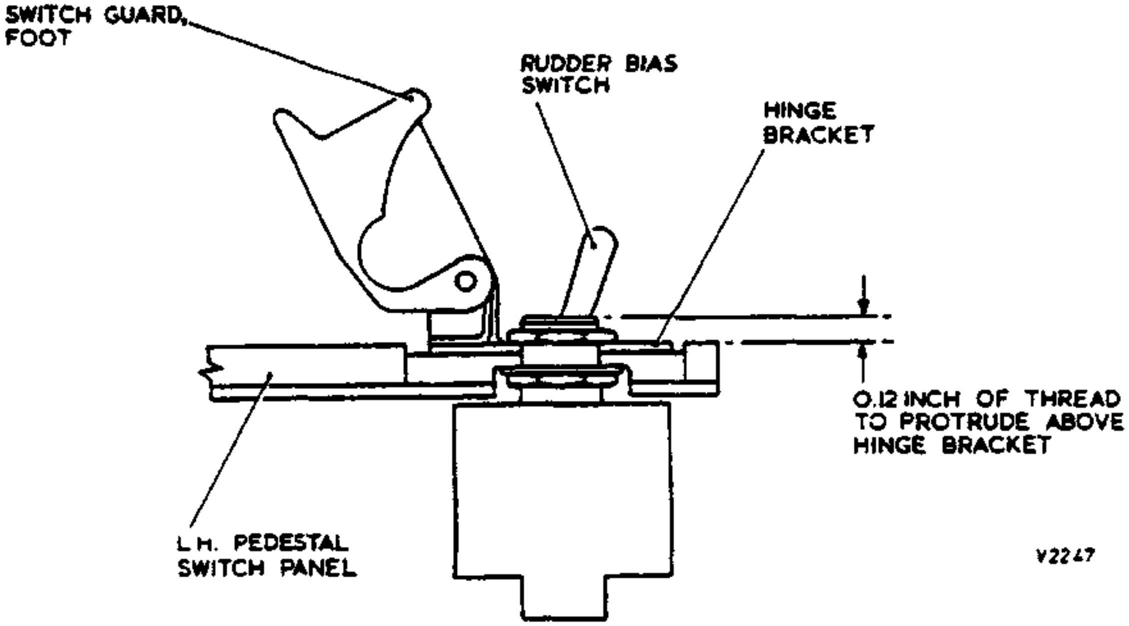
(4) Disconnect one connecting rod from the tab; make sure that the free movement (backlash) measured at the tab trailing edge is not more than 0.06 in. Install and secure the connecting rod. Tighten the nuts and lock with split pins.

(5) Do paragraph (4) again to the other connecting rod.

**H. Do a check of rudder bias switch guard for correct operation** *(Figure 507)*

(1) With the switch guard raised, select the switch to the OFF position.

(2) Make sure that when the guard is closed, the switch is moved to the ON position at the same time, and that the guard feet are in contact with the hinge bracket.


SWITCH GUARD, FOOT
RUDDER BIAS SWITCH
HINGE BRACKET
0.12 INCH OF THREAD TO PROTRUDE ABOVE HINGE BRACKET
L.H. PEDESTAL SWITCH PANEL
V2247

Typical rudder bias switch and guard assembly
*Figure 507*

# RUDDER - MAINTENANCE PRACTICES

## 1. Unit servicing

### A. Lubrication

For routine lubrication data, refer to Maintenance Schedule.

## 2. Removal/Installation (Fig.201)

Equipment and materials required :-

| | |
|---|---|
| Rigging pin set .. .. .. | BAe 25-7Y15A |
| Grease, low temperature .. .. .. | DTD 5598 |
| Jointing compound JC5A .. .. .. | DTD 900/4488 |
| Torque spanner | 110 lb/ins. |
| Grease, MX-33 (pre-mod.25/2348) .. .. | DTD 900/4630 |

**NOTE** : The position of the adjustable rigging plate is determined on production, and it must not be disturbed.

**CAUTION** : DO NOT STRAIN OR DAMAGE TAB CONNECTING ROD EYE ENDS OR OPERATING LEVERS AS SUBSEQUENT FRACTURE MAY OCCUR. DO NOT USE EXCESSIVE FORCE WHEN REMOVING TAB ROD CONNECTING BOLTS.

### A. Remove rudder

(1) Remove spring strut (see Chapter 27, RUDDER SPRING STRUT).

(2) Remove fairing from trim (lower) tab.

(3) Disconnect connecting rods from the trim (lower) tab.

**NOTE** : Do not misalign rod bearings more than 6° or the seals may be damaged.

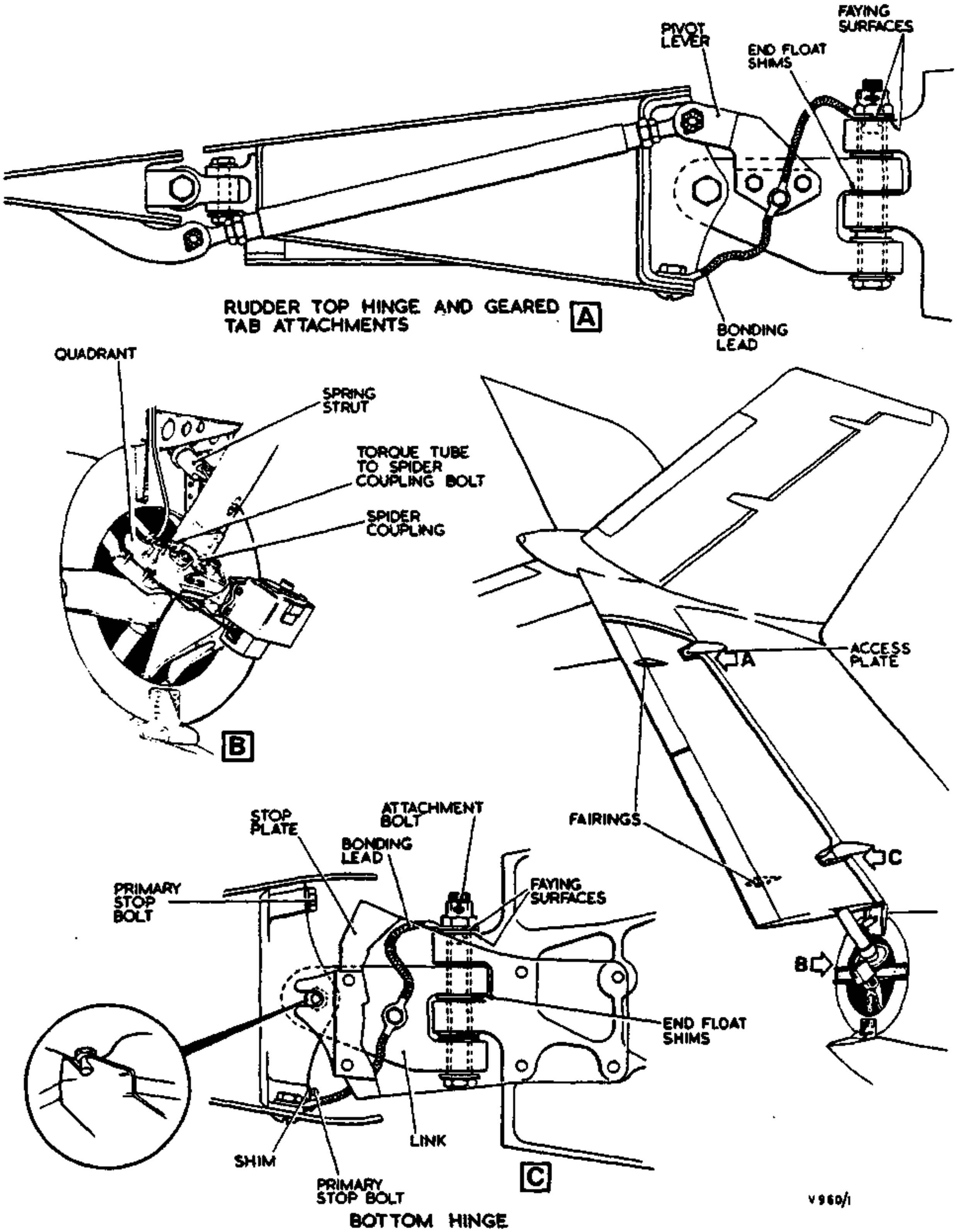
(4) Remove access plates at top hinge.

(5) Support rudder and remove attachment bolts from hinge links and brackets on vertical stabilizer rear spar. Remove bolt securing torque tube to spider coupling; turn and push bolt clear of circlip in torque tube end fitting.

(6) Remove rudder from aircraft, guiding tab connecting rods through structure.

**NOTE** : If spider is removed, note thickness and position of washers located between spider and quadrant.

(7) If applicable, remove static discharge probes (see Chapter 23, STATIC DISCHARGING).



Rudder installation
Fig.201

### B. Checks/Tests before installation

(1) Before fitting a rudder, ensure that if the rudder has been repaired, painted, or if new tabs have been fitted, it has also been re-balanced. Refer to the Structural Repair Manual - Chapter 55 for information on re-balancing.

### C. Install rudder (Fig.201)

NOTE : Before fitting attachment bolts, smear shanks with grease MX-33, assemble bolts with jointing compound under bolt heads and nuts.

Mod.252348 (chromed bolts) use DTD.5598 on bolt shanks.

Effect 20-20-645, para.9 (see Chapter 20, BONDING FOR ELECTRICAL CONTINUITY) on faying surfaces of hinge brackets, washers and bonding leads at top and bottom hinges, see Fig.201.

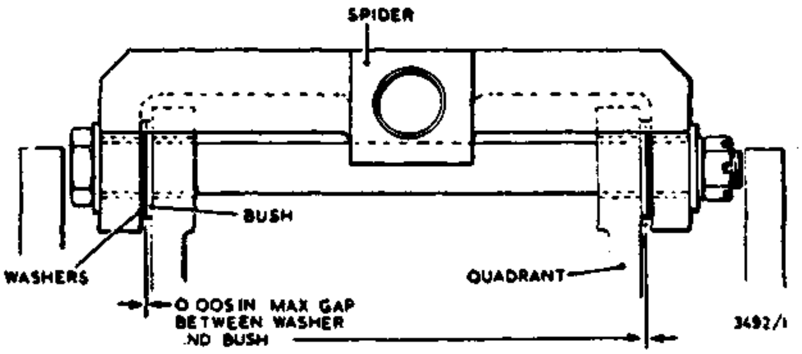
(1) Set rudder trim control to neutral, and check that trim jack is at neutral (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(2) If detached, secure trim tab connecting rods to trim jack (see Chapter 27, TRIM JACK).

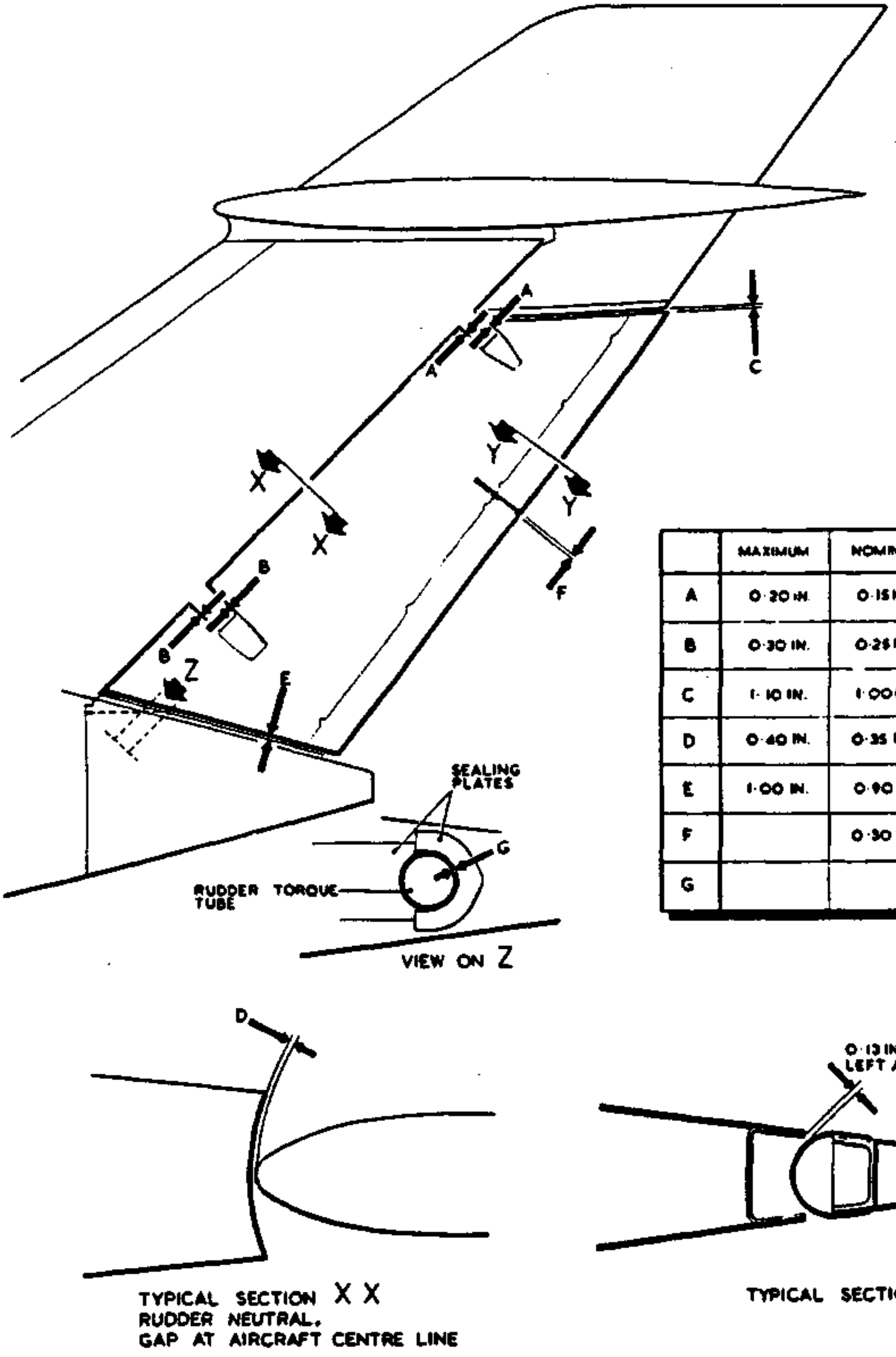
(3) Guide tab connecting rods into rudder, and links into brackets on vertical stabilizer rear spar. Insert attachment bolts through links and brackets. Secure bolts and bonding leads with washers and nuts; tighten nuts to a torque load of 90-110 lb.in.

NOTE: With bolts fully tightened, there should still be a clearance under the bolt head.

When the bottom hinge link enters the bracket, check that spigot bolt engages slot in locating plate.



Detail of shimming
Fig.202



| | MAXIMUM | NOMINAL | MINIMUM |
|---|---|---|---|
| A | 0·20 IN. | 0·15 IN. | 0·10 IN. |
| B | 0·30 IN. | 0·25 IN. | 0·20 IN. |
| C | 1·10 IN. | 1·00 IN. | 0·90 IN. |
| D | 0·40 IN. | 0·35 IN. | 0·30 IN. |
| E | 1·00 IN. | 0·90 IN. | 0·80 IN. |
| F | | 0·30 IN. | |
| G | | | 0·10 IN. |

4124/2

dder and rudder tab clearances
Fig.203

(4) Check rudder for lateral movement between link and attachment bracket of upper and lower hinge assemblies. There should be no end float.

(5) Where lateral movement is evident, remove hinge bolts, install shims as necessary under shoulder of link (LH) bush to eliminate end float and repeat op.(3).

NOTE: For details of shims refer to Overhaul Manual(OM) Chapter 55.

(6) Lock hinge bolts with split pins.

(7) If spider was disturbed, fit washers between spider and bushes in quadrant to achieve a 0.005 in. gap at each end of the spider (Fig.202), and secure spider to quadrant with bolt, washer and slotted nut; lock nut with split pin.

(8) Secure torque tube to spider coupling with bolt, washer and nut; ensure that bolt engages circlip in torque tube end fitting, lock nut with split pin.

(9) Locate access plates on each side of top hinge and secure with bolts.

(10) Secure connecting rods to trim tab with bolts and nuts. Lock nuts with split pins.

NOTE : Do not tilt rod bearing more than 6° or the seals may be damaged.

(11) Examine Thiokol seal on trim tab fairing. If necessary, remove existing Thiokol, and make a new Thiokol seal 0.03 in. thick in accordance with DHA 447 Method 1 (see Chapter 20). Secure fairing to trim tab with bolts.

(12) Position rudder at neutral, and insert rigging pin through quadrant and cable guard plate.

(13) Check neutral setting of trim and geared tab, and adjust as necessary (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(14) Install spring strut (see Chapter 27, SPRING STRUT).

(15) Check rudder and trim tab ranges of movement (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(16) If it is necessary to correct the rudder range of movement, adjust shims of primary stops at bottom hinge. Wire-lock stop bolts after adjustment.

NOTE: Prior to making the above adjustments, ensure there is adequate clearance at the secondary stops, on completion, reset the secondary stop clearances (Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(17) Functionally test rudder and rudder trim control systems (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(18) If a new tail cone or sealing plate has been fitted, file laminated fabric sealing plates to obtain clearance around rudder torque tube (Fig.203). Protect filed edge with Bakelite Damarda lacquer L 3128.

(19) Check clearances shown on Fig.203.

(20) Check free movement of rudder and rudder tabs (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(21) If applicable fit static discharge probes (see Chapter 23, STATIC DISCHARGING.

(22) Check electrical bonding of rudder to aircraft in accordance with 20-20-645 - BONDING FOR ELECTRICAL CONTINUITY (see Chapter 20).

* * *

# RUDDER PEDAL ASSEMBLY REMOVAL/INSTALLATION

**WARNING: WHEN ANY PART OF THIS SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR RENEWED, DETAILED INVESTIGATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT DISTORTION, TOOLS, RAGS OR ANY OTHER LOOSE ARTICLES OR FOREIGN OBJECTS THAT COULD IMPEDE THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM ARE NOT PRESENT, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE WORK AREA ARE CLEAN.**

**WARNING: WHENEVER ANY PART OF EITHER THE MAIN OR ANY ASSOCIATED SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR RENEWED, THAT PART OF THE SYSTEM WHICH HAS BEEN DISTURBED SHALL BE SUBJECTED TO A DUPLICATE INSPECTION FOR SECURITY OF LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITIES.**

**WARNING: WHEN WORKING ON THE FLIGHT CONTROL SYSTEMS, DISPLAY WARNING NOTICES IN THE FLIGHT COMPARTMENT TO PREVENT OPERATION OF THE CONTROLS.**

**WARNING: MAKE SURE THAT THE FLYING CONTROL SURFACE RANGE OF TRAVEL IS CLEAR OF ANY OBSTRUCTIONS.**

## 1. General

| Equipment/Material | Part/Item No. |
|---|---|
| Blanking caps for brake pipes | Local supply |
| Rudder Gust lock | Supplied with Airplane |
| Rigging Pin Set | Refer to the Illustrated Tool and Equipment Manual (ITEM), Chapter 27. |

### A. Lubrication

(1) For routine lubrication data refer to the Aircraft Maintenance Schedule, Part 7.

## 2. Removal/Installation (*Figure 1*)

The following procedures apply to both Rudder Pedal Assemblies. The procedure is written for the right-hand Rudder Pedal Assembly with reference to the left-hand Rudder Pedal Assembly instructions in parenthesis.

### A. Removal

(1) De-energize the aircraft electrical busbars (Chapter 24, ELECTRICAL POWER - GENERAL).

(2) Display warning notices to prevent the use of electrical power.

(3) Release the hydraulic system pressure (Chapter 29, MAIN SYSTEM - MAINTENANCE PRACTICES).

(4) Display warning notices to prevent the use of hydraulic power.

(5) Remove the right-hand (left-hand) crew seat (Chapter 25, FLIGHT COMPARTMENT - CREW SEATS).

(6) Remove the flight compartment carpets (if installed).

**CAUTION: WHEN REMOVING THE FLOOR PANELS MAKE SURE THE SECURING SCREWS ARE IDENTIFIED AND KEPT WITH THE CORRECT PANELS.**

(7) Remove the right-hand (left-hand) flight compartment floor panels, as necessary.

(8) Remove the right-hand (left-hand) control column.

(9) Install the rudder control system rigging pins.

(10) Remove the wirelocking from the aft unions of the rigid brake pipes.

(11) Disconnect the rigid brake pipes at the aft unions and install the blanking caps.

(12) Disconnect the rudder pedal assembly adjustment cable (1) at the lever (2).

(13) Right-hand side only. Remove the split pin, nut, bolt and washer securing the rudder control rod (3) to the rudder pedal assembly.

(14) Right-hand side only. Disconnect the rudder control rod (3) from the rudder pedal assembly.

(15) Left-hand side only. Remove the split pins, nuts, bolts and washers securing each end of the rudder control rod (3).

(16) Left-hand side only. Remove the rudder control rod (3).

(17) Remove the wirelocking from the forward bolts (4) securing the rudder pedal assembly to the aircraft structure.

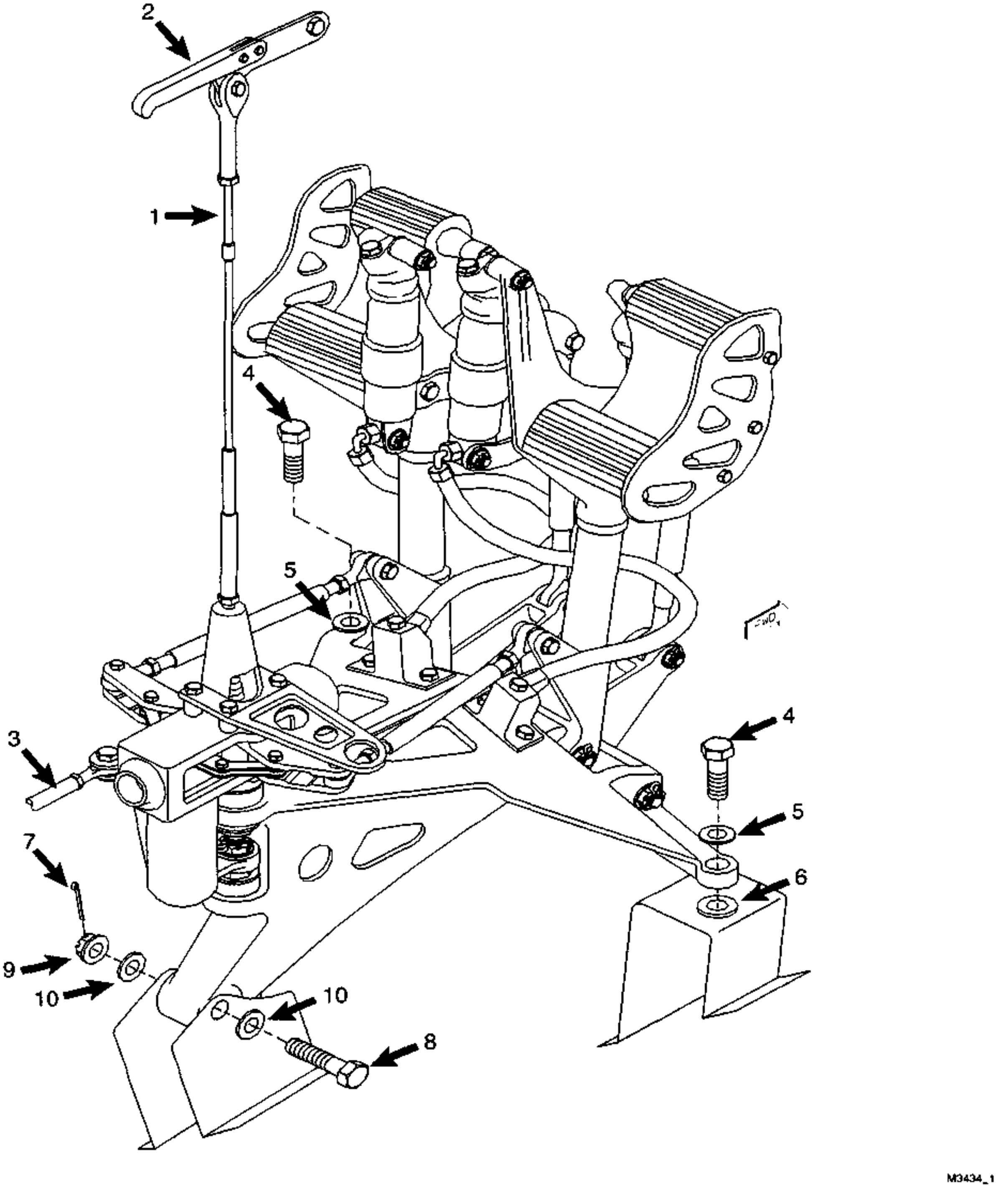
*NOTE: The forward outboard bolt is accessed by moving the outboard rudder pedal aft.*

(18) Remove the forward securing bolts (4), washers (5) and spacer (6) (only the outboard attachment point has a spacer).

(19) Remove the split pin (7) from the aft bolt (8) securing the rudder pedal assembly to the aircraft structure.

(20) Remove the aft securing bolt (8), nut (9) and washers (10).

(21) Remove the rudder pedal assembly.



Rudder Pedal Assembly (RH shown, LH similar but opposite hand)

*Figure 401*

## B. Installation

(1) Position the rudder pedal assembly.

(2) Install the aft bolt (8), nut (9) and washers (10) securing the rudder pedal assembly to the aircraft structure.

(3) Install the split pin (7) to the aft securing bolt (8).

(4) Install the forward bolts (4), washers (5) and spacer (6) (only the outboard attachment point has a spacer) securing the rudder pedal assembly to the aircraft structure.

*NOTE: The forward outboard bolt is accessed by moving the outboard rudder pedal aft.*

(5) Wirelock the forward securing bolts.

(6) Right-hand side only. Connect the rudder control rod (3) to the rudder pedal assembly.

(7) Right-hand side only. Install the nut, bolt and washer securing the rudder control rod (3) to the rudder pedal assembly.

(8) Right-hand side only. Install the split pin to the securing bolt.

(9) Left-hand side only. Install the rudder control rod (3).

(10) Left-hand side only. Install the nuts, bolts and washers securing each end of the rudder control rod.

(11) Left-hand side only. Install the split pins to the securing bolts.

(12) Connect the rudder pedal assembly adjustment cable (1) at the lever (2).

(13) Remove the blanking caps and install the rigid brake pipes.

(14) Wirelock the rigid brake pipe, aft unions.

(15) Remove the rudder control system rigging pins.

(16) Install the right-hand (left-hand) control column.

**CAUTION: WHEN INSTALLING ANY PANELS MAKE SURE THE CORRECT SCREWS ARE USED. PANELS INSTALLED WITH INCORRECT SCREWS CAN CAUSE DAMAGE TO ELECTRICAL WIRING AND CONTROL SYSTEMS.**

(17) Install the right-hand (left-hand) flight compartment floor panels (AMS, Part 6).

(18) Install the flight compartment carpets removed at paragraph A.(6).

(19) Install the right-hand (left-hand) crew seat (Chapter 25, FLIGHT COMPARTMENT - CREW SEATS).

(20) Bleed the master cylinder controls (Chapter 32, WHEELS AND BRAKES - MAINTENANCE PRACTICES).

(21) Remove the warning notices.

(22) Do a function test of the aileron, elevator and rudder control systems.

**C. Close Up**

(1) Make sure the work area is clean and clear of all tools and miscellaneous equipment.

## RUDDER BIAS STRUT - MAINTENANCE PRACTICES

### 1. Removal/Installation

Equipment and materials required :-

| | |
|---|---|
| Rigging pin set | BAe 25-7Y15A |
| Thiokol | PR 1422-2 |

#### A. Remove bias strut

(1) On panel DA/E, trip following circuit breakers :-

STROBE LIGHTS (grid ref. F1), (if applicable)
RUDDER BIAS HEATER (grid ref. B2) and
RUDDER BIAS (grid ref. C2), or
RUDDER BIAS HEATER (grid ref. B3) and
RUDDER BIAS (grid ref. C3) as applicable.

(2) Release toggle fasteners, disconnect strobe light connector (if applicable), and remove tailcone.

(3) Disconnect heater muff electrical cables from terminal block XA. Remove all securing devices from these cables.

(4) Disconnect solenoid cables from terminal block on strut.

(5) Disconnect hoses from bias strut. Blank off hoses and bias strut connections.

(6) Unscrew piston rod from eye-end, remove eye-end from stud (do not remove special radiused washer from spigot), and remove strut body attachment bolt.

(7) Release press studs and remove heater muff from bias strut.

#### B. Install bias strut

(1) Remove eye-end from piston rod; retain lock nut and lock piece on eye-end.

(2) Position heater muff around bias strut and secure with press studs.

(3) Check that special radiused washer is fitted to stud on rudder quadrant and secure bias strut eye-end to stud with nut and split pin. Fit body of bias strut to attachment bracket with bolt, nut and split pin. Physically check that body is secured to attachment bracket.

NOTE : Special washer is assembled with radius adjacent to spigot using Thiokol in accordance with DHA 461 (see Chapter 20).

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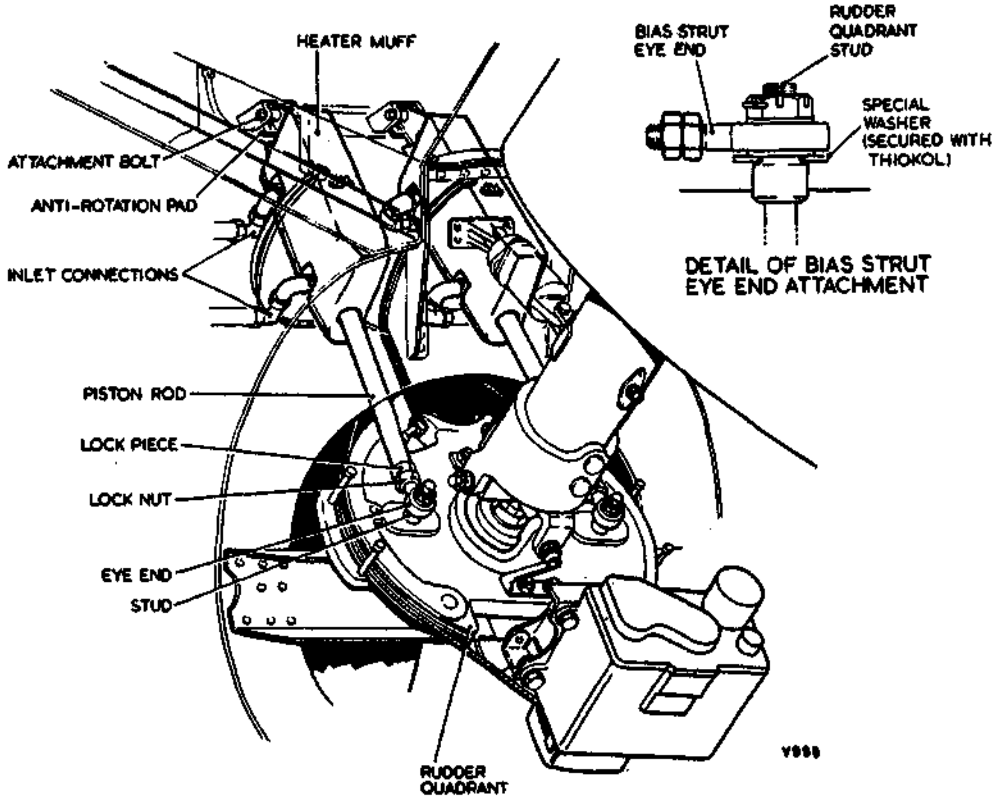
...Rudder bias strut - Maintenance practices continued



Bias strut installation
Fig.201

(4) Connect muff electrical cables to terminal block XA, and solenoid cables to terminal block on strut. Secure electrical cables with P-clips.

(5) Manually set rudder to full left or right travel as applicable, to extend strut, with the primary stops contacted. Ensure that lock nut and lock piece are fitted on eye-end of bias strut, and screw piston rod on to eye-end until piston contacts internal stop in bias strut; ensure that rudder does not creep away from full travel during this operation. From this position, screw piston rod in by 0.15 in. Check that eye end is in safety; locate lock piece in slot in piston rod, tighten lock nut and wire-lock lock piece.

NOTE : Rudder spring strut may be temporarily disconnected to facilitate buas strut adjustment. After adjustment, ensure that spring strut is secured with bolt, washer and nut; lock nut with split pin.

...Rudder bias strut - Maintenance practices continued

(6) Remove blanks from hoses and bias strut inlet connections. Fit hoses to bias strut, tighten union nuts, and wire-lock. Ensure that wire-locking will not damage heater muff.

(7) Check electrical bonding of bias strut to aircraft (see Chapter 20, DHS 645).

(8) Offer up tail cone, connect strobe light connector (if applicable) and secure tail cone with toggle fasteners.

(9) Reset circuit breakers.

(10) Leak test rudder bias system (see Chapter 27, RUDDER BIAS SYSTEM PIPING).

(11) Functionally test rudder bias system (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(12) Functionally test rudder bias strut heater muff (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(13) If applicable, functionally test strobe light (see Chapter 33, EXTERIOR LIGHTS).

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## 2. Inspection/Check

### A. Functionally test bias strut efficiency (Fig.202)

Special tools and equipment :

Spring balance, reading up to 115 lb.

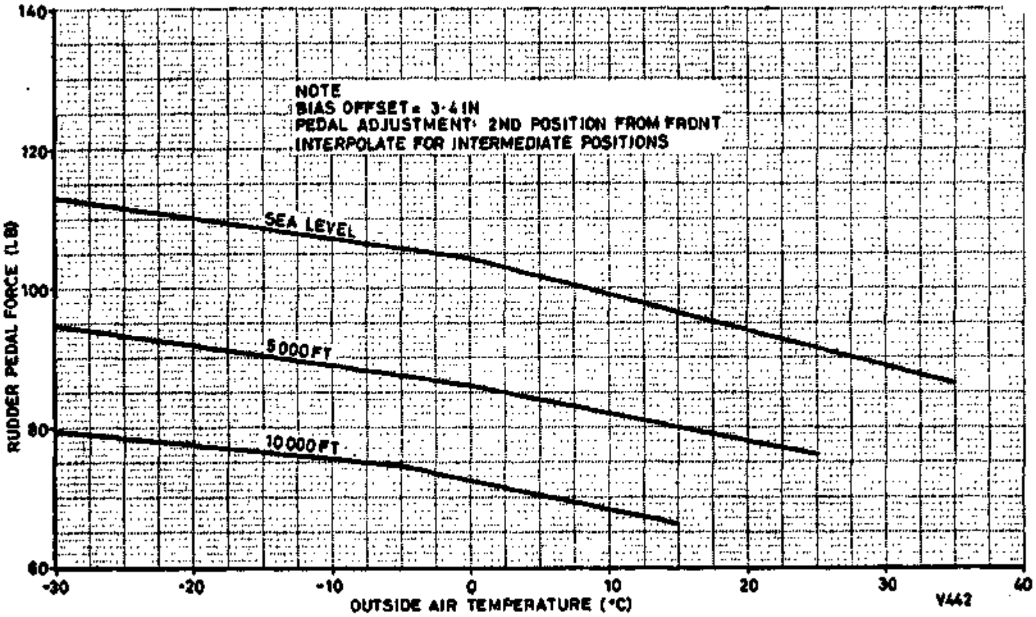
NOTE : The bias system piping must be free of leaks, refer to Chapter 27, RUDDER BIAS SYSTEM PIPING.

(1) Set aircraft altimeter barometric scale to read 1013.0 mb. Record altitude shown by altimeter.

(2) Record ambient air temperature, using a thermometer graduated in 1°C divisions.

NOTE : Do not use an aircraft outside air temperature gauge, or any instrument located near a reflective surface which could influence the indicated temperature.

(3) Adjust rudder pedals to the first position aft of fully forward.



Rudder pedal load and asymmetric thrust relationship
Fig.202

(4) Attach spring balance to right rudder pedal of either rudder pedal assembly, at point shown on Fig.203.

(5) Start and run engine No.2 at 75% N1 (see Chapter 71, GENERAL).

(6) Pull the rudder pedal slowly aft with the spring balance, and record the force registered as the pedal passes through the neutral position. Allow the rudder pedal to move slowly forward, and again record the force registered at the neutral position. Calculate the average of the forces recorded.

NOTE : Maintain the load applied by the spring balance in a horizontal plane throughout this operation.

(7) Stop engine No.2 (see Chapter 71, GENERAL).

(8) Remove the spring balance from right rudder pedal, and attach spring balance to left rudder pedal of the same assembly, at point shown on Fig.203.

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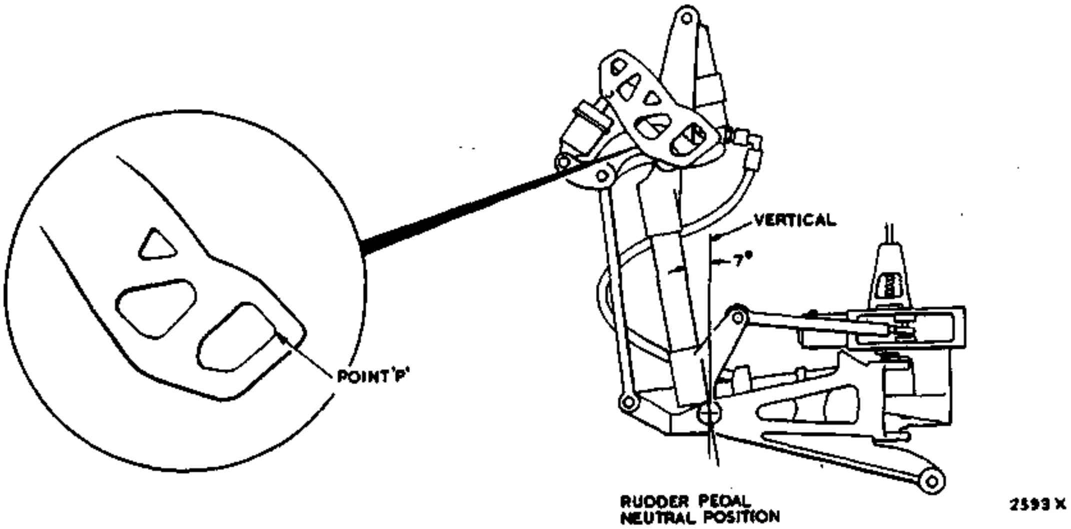

Spring balance attachment point
Fig.203

(9) Start and run engine No.1 at 75% N1 (see Chapter 71, GENERAL).

(10) Pull the rudder pedal slowly aft with the spring balance, and record the force registered as the pedal passes through the neutral position. Allow the rudder pedal to move slowly forward, and again record the force registered at the neutral position. Calculate the average of the forces recorded.

NOTE : Maintain the load applied by the spring balance in a horizontal plane throughout this operation.

(11) Stop engine No.1, (see Chapter 71, GENERAL).

(12) The average of the forces recorded in operation (6) and (10) should be within ± 15 lb of the relevant load shown on Fig.202. In either case, failure to meet the required figure means that the bias strut must be renewed.

...See NOTE overleaf

...Rudder bias strut - Maintenance practices continued

NOTE : A worked example is given below.

Preliminary data

| | |
|---|---|
| Altimeter reading ... ... ... ...<br>(Barometric scale set to 1013.0 mb) | 180 ft. |
| Ambient air temperature ... ... ... | 7.5°C |

From the above data and the graph on Fig.202, the predicted rudder pedal load for an aircraft with TFE 731-3 engines, operating at 75% N1 rev/min, is 99.5 lb.

Test data

| | |
|---|---|
| Average of spring balance readings ... ...<br>(No.1 engine stopped) | 105 lb |
| Average of spring balance readings ... ...<br>(No.2 engine stopped) | 103 lb |

Conclusion

The discrepancies between the predicted rudder pedal load (Preliminary data) and the averages of spring balance readings (Test data) are 5.5 lb and 3.5 lb. These discrepancies are within the allowed tolerance of ± 15 lb, and the bias strut is serviceable.

* * *

## RUDDER BIAS SYSTEM PIPING - MAINTENANCE PRACTICES

### 1. Electrical bonding

When any part of the system is refitted, it must be electrically bonded in accordance with DHS 645, (see Chapter 20). After connection, check the electrical continuity of relevant joints.

### 2. System leakage

#### A. General

When any joint in the system is re-made, it must be tested for leaks (para.B).

#### B. Leak test

NOTE : Ear defenders must be worn by personnel carrying out this test.

Materials required :-

Nonidet LE
Distilled water

(1) Start and run engines at take-off rev/min (see Chapter 71, GENERAL).

(2) Gain access to rudder bias system piping in rear equipment bay, and left and right engine fillets.

(3) Using a leak detection solution of 5% Nonidet LE and 95% distilled water, check each pipe joint for leakage. No leakage is allowed at any joint.

(4) Stop engines (see Chapter 71, GENERAL).

(5) On completion of test, remove all traces of solution with distilled water, and dry off any remaining moisture.

* * *

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## RUDDER SPRING STRUT - MAINTENANCE PRACTICES

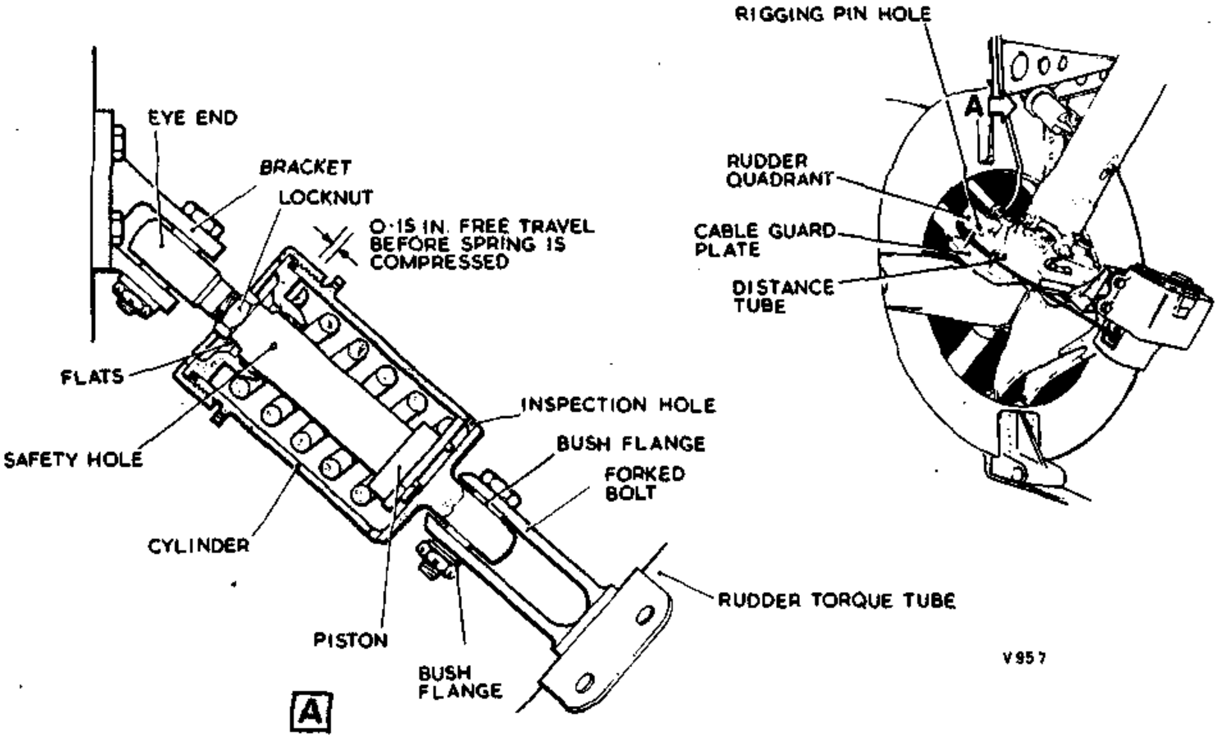
1. Removal/Installation (Fig.201)

A. Remove spring strut

(1) If applicable, on panel DA/E, trip STROBE LIGHTS circuit breaker (grid ref. F1) (see Chapter 24, GENERAL).

(2) Release toggle fasteners, disconnect strobe light connector (if applicable), and remove tailcone.

(3) Remove bolts securing spring strut to bracket and forked bolt, and remove spring strut.



Spring strut installation
Fig.201

B. Install spring strut

Special tools and equipment

Rigging pin set .. .. .. .. BAe 7Y15A

(1) Secure eye end to bracket with bolt, washer and nut, and secure cylinder to forked bolt and nut, ensuring that the bushes are fitted as shown on Fig.201. Lock nuts with split pins.

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...Rudder spring strut - Maintenance practices continued

NOTE : Until any necessary adjustment has been made to the length of the spring strut, the rudder must not be moved to the neutral position as the piston may bottom on the cylinder.

(2) Slacken locknut and adjust length of spring strut so that aft face of piston is aligned with forward edge of inspection hole when the rudder is in the neutral position (see Fig.201). Check rudder neutral position by inserting rigging pin through rigging pin holes in quadrant and cable guard. Check that spring strut eye end is in safety, tighten locknut and wire-lock. Ensure that wire-locking will not foul spring strut during operation.

NOTE : To adjust length of spring strut, operate rudder by hand and extend spring strut to obtain access to flats on piston. similarly extend spring strut when checking that eye end is in safety.

(3) Remove rigging pin.

(4) Offer up tailcone, connect strobe light connector (if applicable) and secure tailcone with toggle fasteners.

(5) Reset circuit breaker (if applicable).

(6) If applicable, functionally test strobe light (see Chapter 33, EXTERIOR LIGHTS).

(7) Functionally test rudder control system (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

* * *

# RUDDER TRIM JACK - MAINTENANCE PRACTICES

## 1. Unit servicing

### A. Lubrication

For routine lubrication data, refer to the Maintenance Schedule.

## 2. Removal/Installation (Fig.201)

Materials required :

| | | |
|---|---|---|
| Grease, low temperature | .. .. | DTD 844, 866 or 5598 |
| Grease, MX-33 (pre Mod.25/2728) | .. | DTD 900/4630 |
| Jointing compound JC5A | .. .. | DTD 900/4488 |

### A. Remove trim jack

CAUTION : TRIM JACKS ARE INDIVIDUALLY ADJUSTED ON INSTALLATION, AND ARE NOT INTERCHANGEABLE. LABEL TRIM JACK FOR IDENTIFICATION.

(1) Remove rudder (see Chapter 27, RUDDER).

(2) Operate rudder trim control to neutral.

(3) To prevent movement of torque shaft due to cable tension, temporarily insert a suitable wooden block between torque shaft and diaphragm.

(4) Remove bolts which secure trim jack to stop plate and diaphragm, and withdraw trim jack rearward; retain shim and locating plate.

(5) Operate trim jack, and extend fork-ends; remove bolts and nuts, and detach connecting rods from fork-ends. Refit bolts and nuts to rams.

NOTE : Do not extend fork-ends more than necessary for access to bolts, or fork-ends will become disengaged from jack.

Do not tilt rod bearings more than 6° or the seals may be damaged.

### B. Install trim jack

NOTE : Due to non-interchangeability, it is only permissible to install a trim jack with an undrilled end-cap, or the jack which was previously in this position. For the latter, the procedure ends at operation (8).

(1) Operate trim jack, and extend fork-ends; remove bolts and nuts supplied with jack.

NOTE : Do not extend fork-ends more than necessary for access to bolts, or fork-ends will become disengaged from jack.

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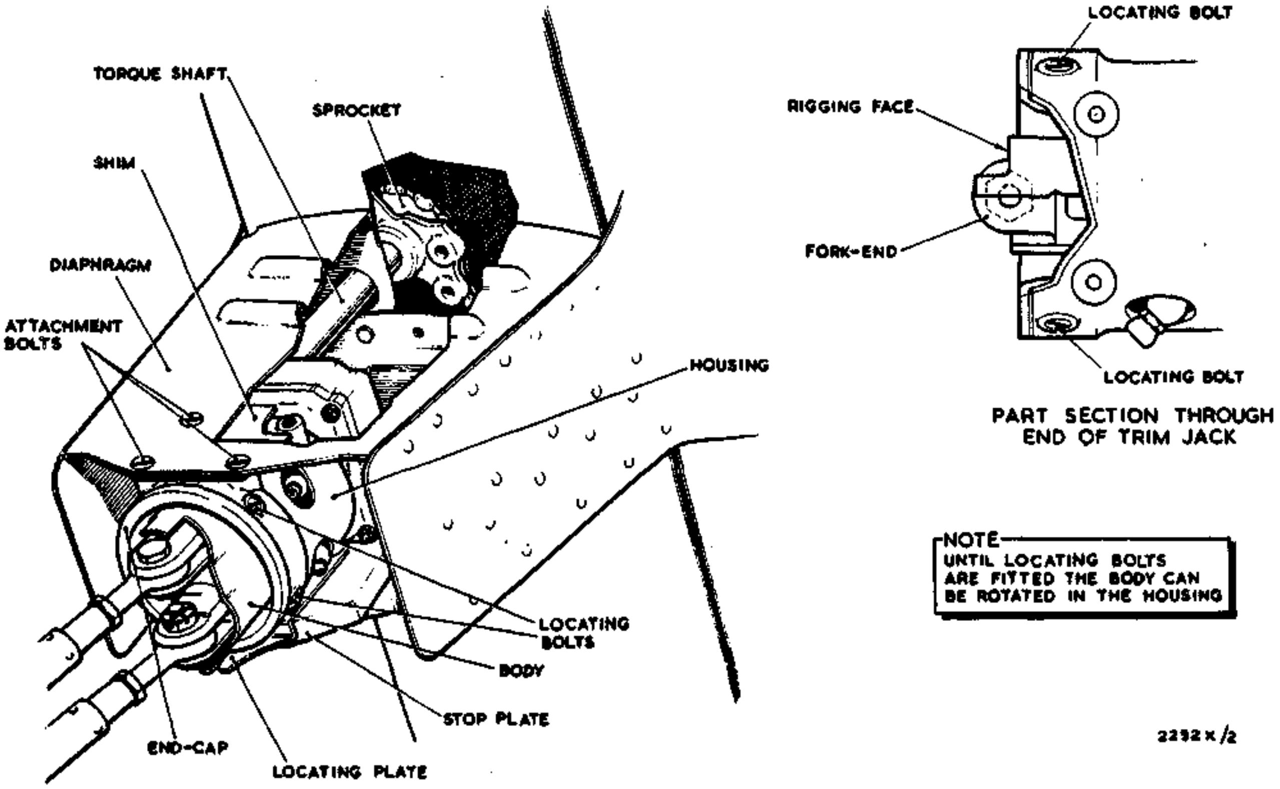
...Rudder trim jack - Maintenance practices continued



PART SECTION THROUGH END OF TRIM JACK

NOTE
UNTIL LOCATING BOLTS ARE FITTED THE BODY CAN BE ROTATED IN THE HOUSING

Trim jack installation
Fig.201

(2) Attach connecting rods to fork-ends with bolts and nuts supplied with jack, lock bolts with split pins; ensure that the following conditions are met :-

- (a) Care must be exercised when entering rod eye end into fork-end; do not misalign rod bearings more than 6° or the seals may be damaged.
- (b) That nuts butt against shoulders on fork-ends.
- (c) Split pins are fitted in line with axis of fork-end movement.

(3) Check that rudder trim chain is equally disposed about sprocket.

(4) Operate trim jack by hand to neutral position by aligning centre of hole in fork-ends with rigging face (see Fig.201).

NOTE : When the connecting rods are fitted, this is achieved by aligning the corners of the nuts on the fork-ends with the rigging face.

...Rudder trim jack - Maintenance practices continued

(5) Smear trim jack serrated shaft with grease, low temperature.

(6) Locate trim jack between stop plate and diaphragm, with shim and locating plate positioned as shown on Fig.201. Engage torque shaft with trim jack drive. Coat attachment bolts with jointing compound and secure trim jack to stop plate and diaphragm.

(7) Install rudder (see Chapter 27, RUDDER).

NOTE : If a trim jack with an undrilled end-cap is being installed, the rudder and trim tab movements cannot be finally checked until the locating bolts are fitted. However, during operations (9) and (10), it is essential that the full and free movement is not curtailed.

(8) Lubricate jack through the two nipples with grease MX-33 (pre Mod. 25/2728) or DTD 5598 (Mod.25/2728).

NOTE : These two greases must not be mixed.

(9) To prevent trim jack operating effort increasing at extremes of rudder movement, it is essential that centres of fork-ends lie on a line parallel to the rudder hinge line. To achieve the required condition, make small rotational adjustments to the position of the jack body in the housing; lock the body after each adjustment to prevent unintentional rotation.

(10) After each adjustment, check the trim jack operating effort over the full trim range, while the rudder is operated over full range (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

(11) When a uniform operating effort is achieved, secure end-cap to housing in the following manner. Drill four 0.1935 in. dia.holes in the end-cap from existing holes in housing. Coat locating bolts with jointing compound, fit bolts and tighten stiffnuts.

(12) Functionally test rudder trim control system (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

* * *

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# RUDDER SERVO MOUNTING - MAINTENANCE PRACTICES

## 1. Removal/Installation (Fig.201)

### A. Remove servo mounting

(1) Remove rudder servo from servo mounting (see Chapter 34, RUDDER SERVO UNIT).

(2) Remove bolts and distance tubes from cable guard plate.

(3) Detach cables between servo mounting and rudder quadrant from rudder quadrant.

(4) Remove four bolts securing servo mounting to mounting bracket. Remove servo mounting complete with cables.

(5) Remove cable guard and guard posts from servo mounting. Retain cable guard.

(6) Remove screws and lock washers from each end of cable groove, and detach cables from capstan (cable drum).

### B. Install servo mounting

NOTE : Operation (1) and (2) are only applicable if a new servo mounting is being fitted. Operations (3) and subsequent apply if the existing servo mounting is being refitted.

Special tools and equipment :-

| | | | |
|---|---|---|---|
| Rigging pin set | .. | .. | HSA 25-7Y15A |
| Tensiometer | .. | .. | Teleflex T5/2002/401/00 |

(1) Remove and discard ring, mounted on guard posts, over end of cable drum. Remove guard posts.

(2) Remove screws and lockwashers from each end of cable groove.

(3) Fit cable ends into cable drum, and fit screws and lockwashers at each end of the cable groove. Tighten screws and wire-lock. Wrap cables onto cable drum as shown on Fig.201.

NOTE : Cables between servo mounting and rudder quadrant are identical.

(4) Secure four guard posts to servo mounting at positions shown on Fig.201 and wire-lock. Position cable guard with cable exits located as shown on Fig.201, and secure to servo mounting with screws. Wire-lock screws in pairs.

NOTE : Screws securing cable guard fit into guard posts.

(5) Locate servo mounting on mounting bracket, and secure with four bolts, washers and stiffnuts.

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...Rudder servo mounting - Maintenance practices continued

(6) Set rudder controls to neutral, and insert rigging pin through rudder quadrant and cable guard plate (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).

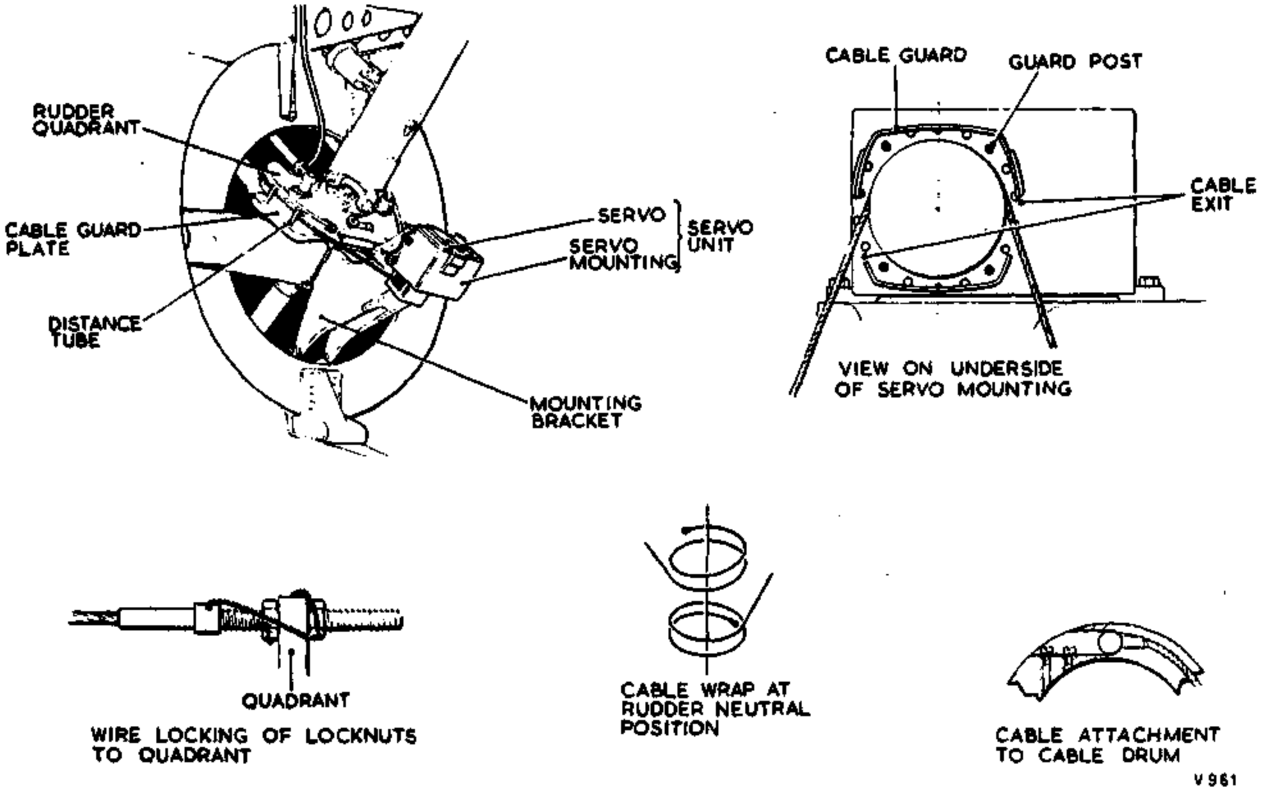
(7) Secure cables to rudder quadrant with nuts. Set tensiometer to suit 10 cwt cables, and position it midway between rudder quadrant and cable drum. Tension cables to 95-100 lb. After adjustment, tighten locknuts and wire-lock nuts together and to cable end. Remove rigging pin.

(8) Secure distance tubes to cable guard plate with bolts.

(9) Operate rudder pedals through full range allowed by rudder primary stops. check servo mounting and associated cables for full and free movement.

(10) Install rudder servo unit (see Chapter 34, RUDDER SERVO UNIT).

(11) Functionally test rudder control system (see Chapter 27, RUDDER AND RUDDER TRIM CONTROL SYSTEMS).



VIEW ON UNDERSIDE OF SERVO MOUNTING

WIRE LOCKING OF LOCKNUTS TO QUADRANT

CABLE WRAP AT RUDDER NEUTRAL POSITION

CABLE ATTACHMENT TO CABLE DRUM

Servo mounting installation
Fig.201

* * *

# ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS - DESCRIPTION AND OPERATION

## 1. Elevator control system (Fig.1)

The control column is linked by connecting rods and a bellcrank to a pulley drum under the flight compartment floor; a further connecting rod links the right column to the pulley drum when duplicate controls are fitted. Cables connect the pulley drum to a circular and elliptical pulley drum in the rear equipment bay; the elliptical pulley gives a progressive increase in elevator movement as the column is moved away from neutral. Cables from the elliptical pulley connect to a quadrant at the top of the vertical stabilizer. The quadrant is linked by two connecting rods to the elevator operating levers.

A spring and G-weight act on the left column, assisting control of the elevator system; together, they minimize variation in stick force per G with differing aircraft loading conditions.

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## 2. Elevator stops

The primary stops are located at the left and right elevator intermediate hinge; shim adjusted stop bolts on the elevator contact a fixed stop on the horizontal stabilizer. Secondary stops are located at the elevator pulley drum under the flight compartment floor ; when the primary stops take effect, a clearance exists at the secondary stops.

## 3. Elevator trim control system (Fig.2)

### A. General

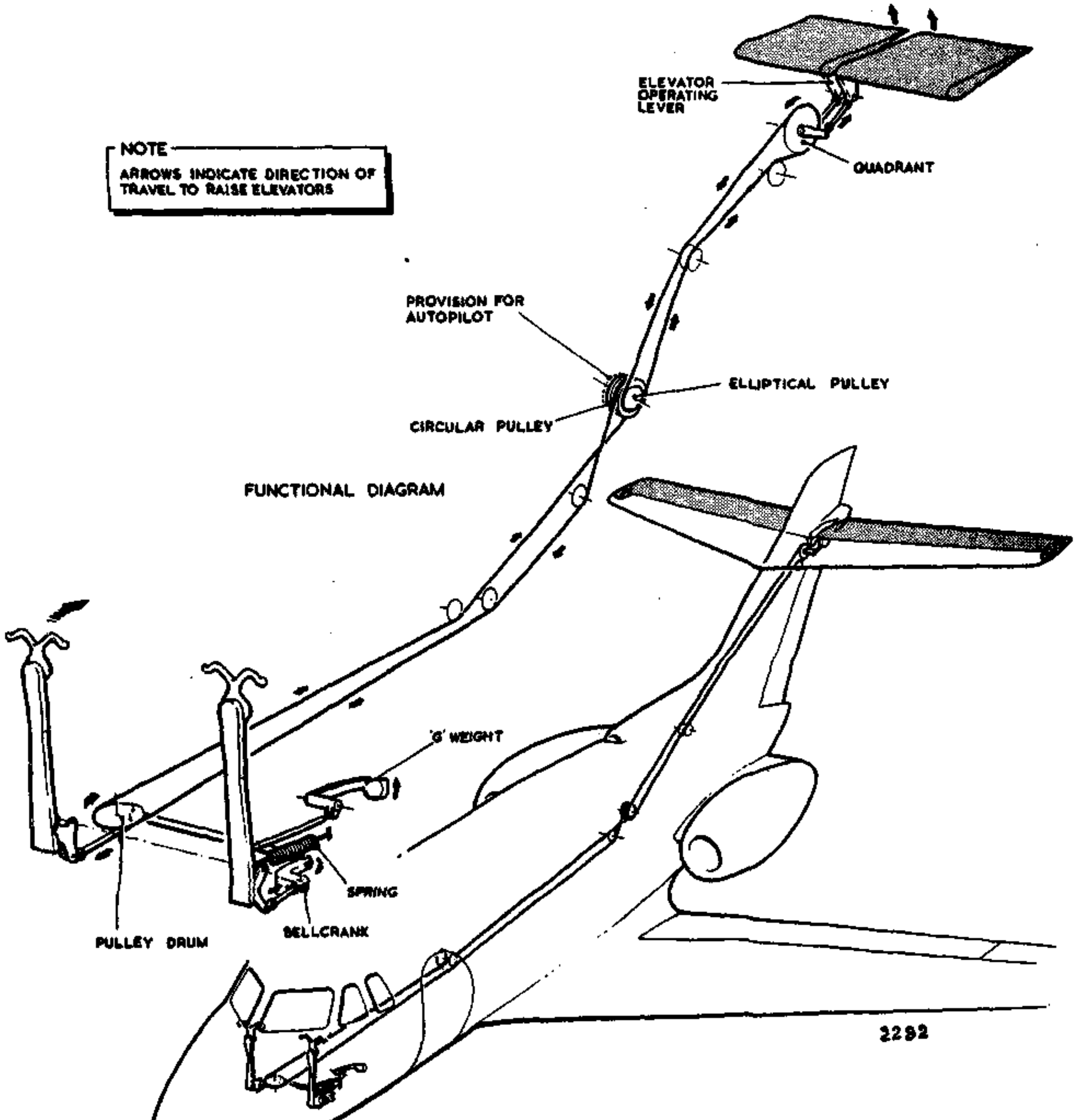
A trim tab on each elevator is controlled from a trim box in the control pedestal. Cables and chains connect a sprocket in the trim box to two sprockets mounted on the horizontal stabilizer rear spar. A torque shaft connects each sprocket to a trim jack. The trim jacks are non-reversible screw types, with twin output fork-ends operated by a common drive. Two connecting rods pass through each elevator to link the trim jacks to the tabs.

When the elevator trim control is at neutral, operation of the elevator moves the trim tab to give servo action. This is caused by the relationship of the trim jack to the elevator hinge line.

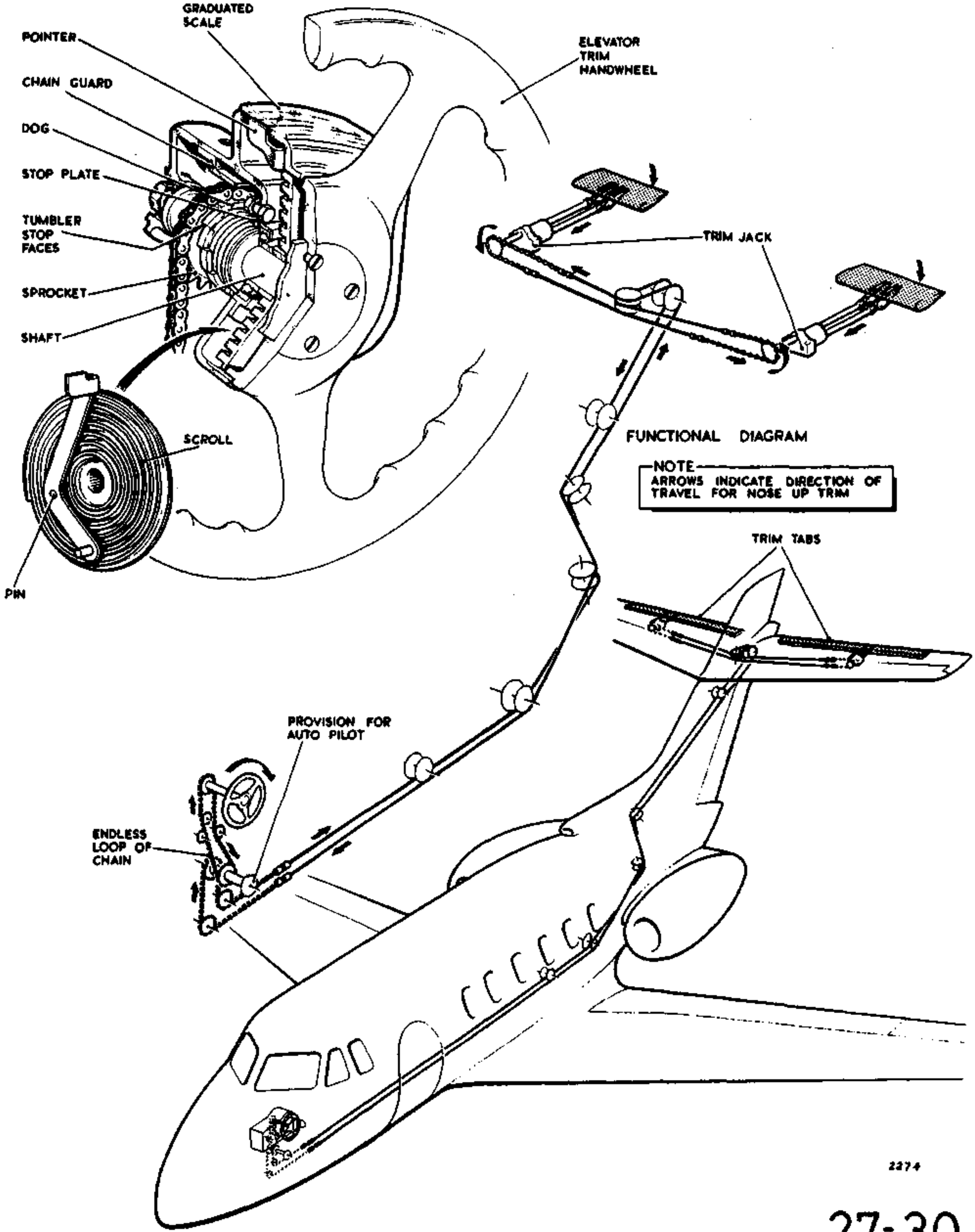
### B. Trim box

An elevator trim handwheel and scroll plate are secured to a shaft which rotates in the trim box; a sprocket is splined onto the shaft. Six tumblers are a running fit on the shaft; each tumbler embodies a stop face, which contacts the stop face of the adjacent tumbler. The first and sixth tumbler stop faces contact a fixed stop plate and a dog on the sprocket. The tumblers allow 5.22 handwheel revolutions.

The scroll plate is helically grooved on its inboard face; a pointer, fitted with a pin which locates in this groove, indicates trim position on a label (graduated scale).



Elevator control system
Fig.1



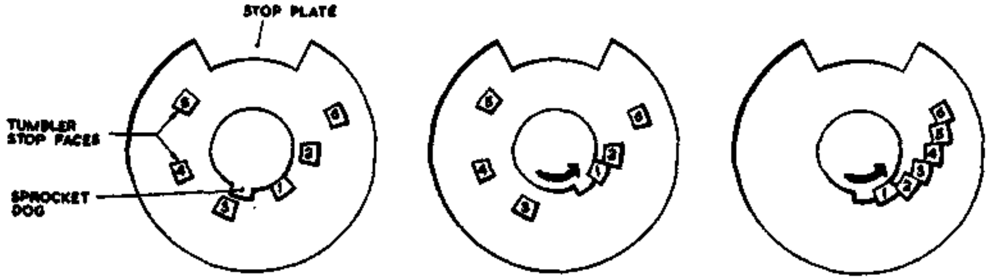
NOTE
ARROWS INDICATE DIRECTION OF TRAVEL FOR NOSE UP TRIM

Elevator trim control system
Fig.2

...Elevator and elevator trim control systems - Description and operation continued

### C. Operation

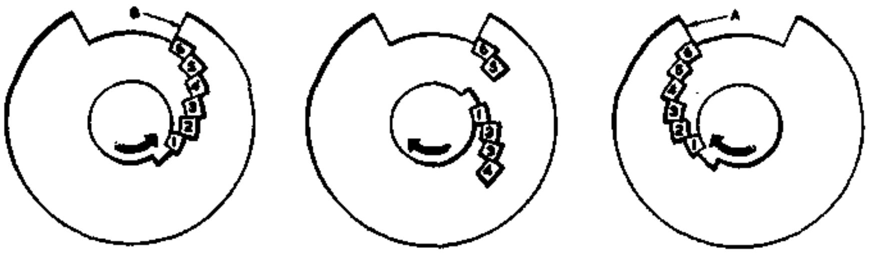
Rotation of the elevator trim handwheel turns the sprocket, the dog on the sprocket contacts the stop face of the adjacent tumbler. Each successive revolution engages another tumbler. The schematic operation on Fig.3 (a) to (d) shows tumbler movement in one trim sense. Trim movement in the opposite sense (Fig.3 (e) and (f)) moves the sprocket so that the opposite face of the dog contacts the other stop face of tumbler No.1.



(a) TRIM NEUTRAL

(b) DOG HAS MOVED TUMBLER 1 TO 2

(c) DOG HAS MOVED TUMBLERS 1,2,3,4,5 TO 6



(d) MAXIMUM TRIM RANGE IS ACHIEVED WHEN FACE 'B' ARRESTS TUMBLER MOVEMENT

(e) TRIM IN OPPOSITE SENSE MOVES TUMBLERS 1,2,3 ETC.

(f) MAXIMUM TRIM RANGE IN OPPOSITE SENSE ACHIEVED WHEN FACE 'A' ARRESTS TUMBLER MOVEMENT

Schematic operation of trim stops
Fig.3

### D. Elevator trim stops

The range of movement of the trim tabs is limited solely by the stop faces of the tumblers in the trim box. There is no adjustment to the trim tab range of movement.

* * *

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# ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS - ADJUSTMENT/TEST

**WARNING: IF A PART OF THIS SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, A FULL EXAMINATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT DISTORTION, TOOLS, RAGS, OTHER LOOSE OBJECTS OR UNWANTED MATERIAL THAT COULD PREVENT THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM ARE NOT PRESENT, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE WORK AREA ARE CLEAN.**

**WARNING: IF A PART OF EITHER THE MAIN OR ANY ASSOCIATED SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, THAT PART OF THE SYSTEM WHICH HAS BEEN CHANGED SHALL BE GIVEN AN ADDED INSPECTION FOR CORRECTLY INSTALLED LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

**WARNING: WHEN WORKING ON THE FLIGHT CONTROL SYSTEMS, DISPLAY WARNING NOTICES IN THE FLIGHT COMPARTMENT TO PREVENT OPERATION OF THE CONTROLS.**

**WARNING: MAKE SURE THAT THE FLYING CONTROL SURFACE RANGE OF TRAVEL IS CLEAR OF ANY OBSTRUCTIONS**

## 1. Rig elevator control system

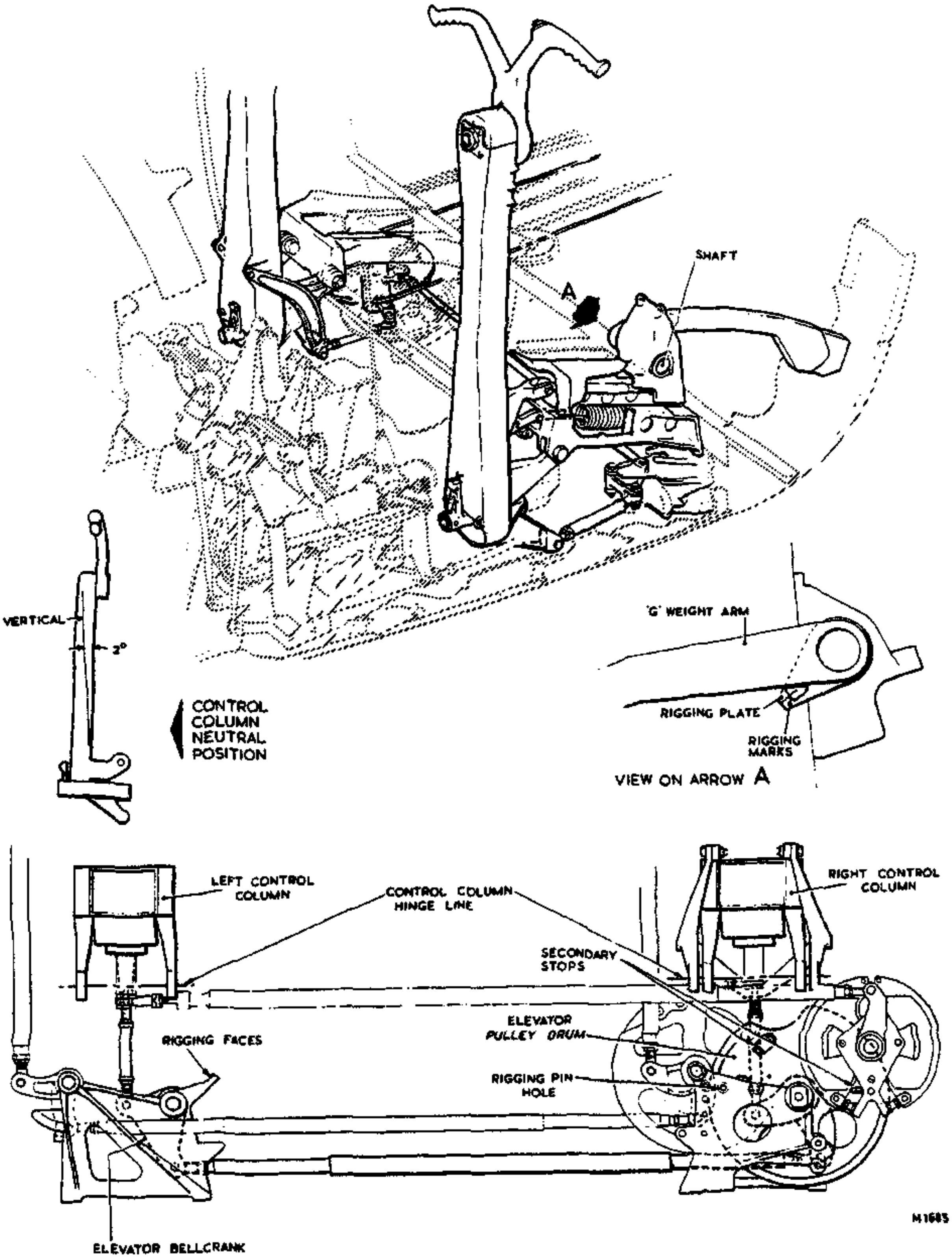
| Equipment/Material | Part/Item No. |
|---|---|
| Rigging pin set | 25Y493AB |
| Rigging plate | 25Y73A |
| Incidence board | 25Y195A |
| Tensiometer | Teleflex T5/2002/401/00 |
| Inclinometer | Local supply |

### A. Rig elevator control system forward of pulley drum *(Figure 501)*

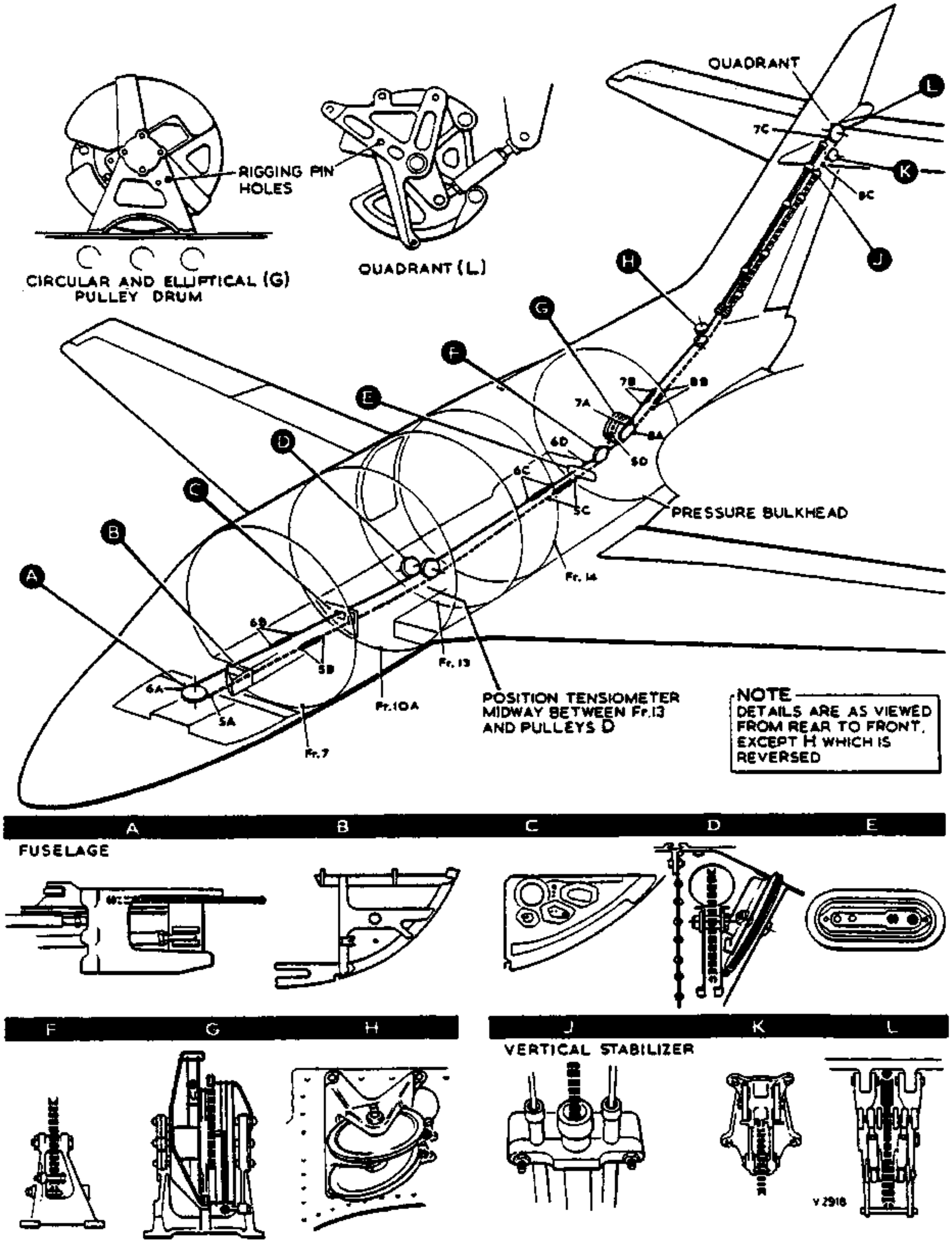
(1) Level the airplane (Chapter 8, LEVELLING AND WEIGHING).

(2) Insert a rigging pin through the rigging pin holes in the elevator pulley drum and its mounting under the flight compartment floor.

(3) Make sure that the rigging faces on the elevator bellcrank and its mounting are aligned. If necessary, adjust the connecting rod between the bellcrank and the elevator pulley drum to align the rigging faces. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.



Elevator controls in forward fuselage
*Figure 501*



POSITION TENSIOMETER MIDWAY BETWEEN Fr.13 AND PULLEYS D

NOTE
DETAILS ARE AS VIEWED FROM REAR TO FRONT, EXCEPT H WHICH IS REVERSED

Elevator control system rigging

*Figure 502*

(4) Use an inclinometer to make sure that the left control column is at its neutral position. If necessary, adjust the connecting rod between the elevator bellcrank and the left control column to get the control column neutral position. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

(5) Use an inclinometer to make sure that the right control column is at its neutral position. If necessary, adjust the connecting rod between the right control column and the bottom integral lever of the elevator pulley drum to get the control column neutral position. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

(6) Make sure that the rigging marks on the G weight arm and the rigging plate are aligned. If necessary adjust the connecting rod between the left control column and the shaft which carries the G weight arm, to align the rigging marks. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

**B. Rig elevator control system aft of pulley drum** *(Figure 502)*

(1) Insert a rigging pin through the rigging pin holes in the circular and elliptical pulley drum and its mounting. Make sure that the lower cable on the elliptical pulley is in its groove. If the rigging pin cannot be inserted, adjust the turnbuckles connecting cable ends 5B-5B, 5C-5C, 6B-6B and 6C-6C to align the rigging pin holes.

(2) Set the tensiometer for 25 cwt cable and position the tensiometer as shown. Tension the cables to between 70 lb and 80 lb. Make sure that all turnbuckles are in safety, tighten the locknuts and lockwire.

(3) Insert a rigging pin through the rigging pin holes in the quadrant and its mounting. If the rigging pin cannot be inserted, adjust the turnbuckles that connect cable ends 7B-7B and 8B-8B to align the rigging pin holes.

(4) Set the tensiometer for 25 cwt cable:

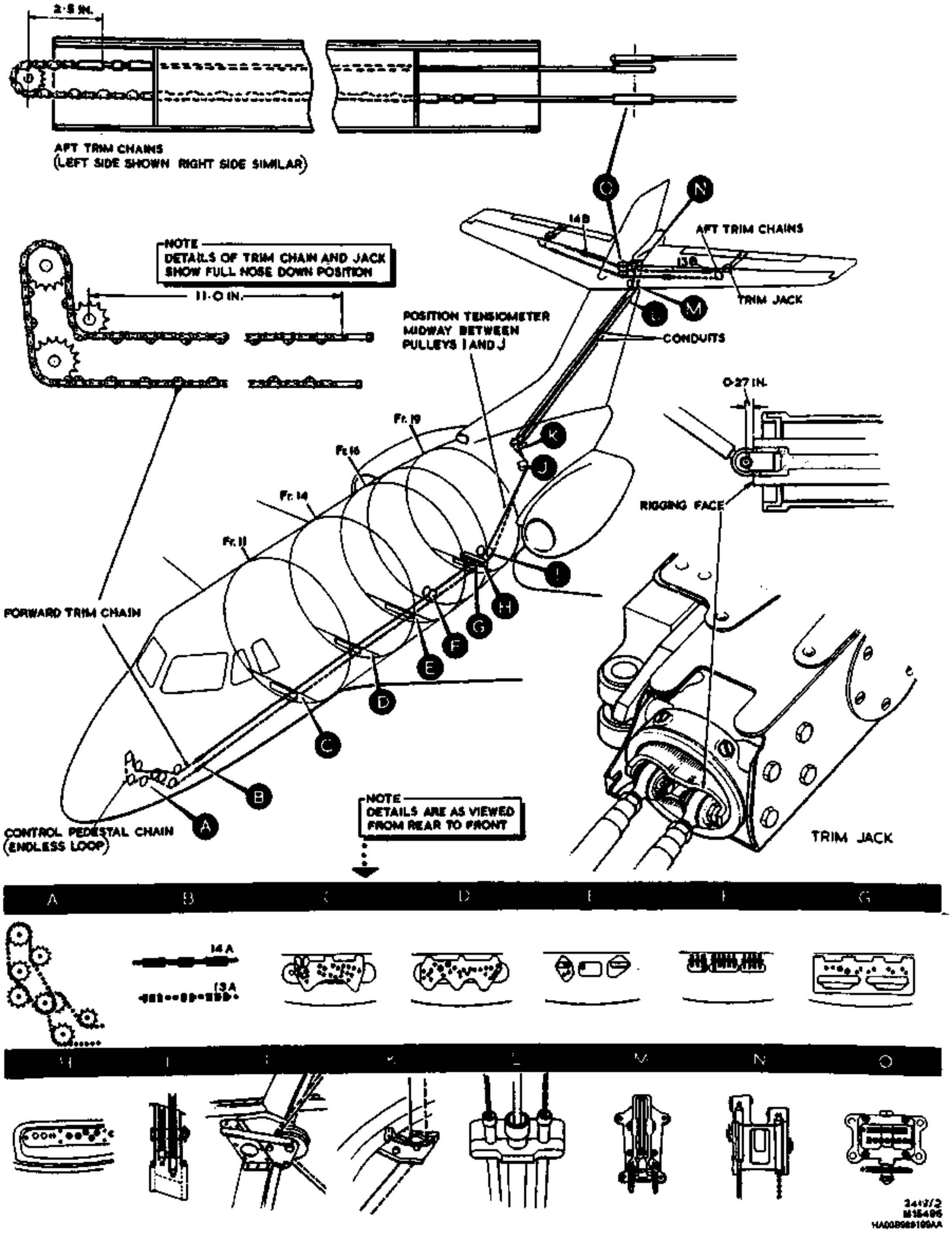
(a) Position the tensiometer on cable coded No. 7 midway between the elliptical pulley drum and turnbuckles that connect cable ends 7B-7B; tension the cable to between 85 lb and 95 lb.

(b) Position the tensiometer on the cable coded No. 8 midway between the upper end of the swaged tube and the pulleys located at frame 23; tension the cable to between 85 lb and 95 lb. Make sure that all turnbuckles are in safety, tighten the locknut and lockwire.

(5) Assemble the rigging plate and incidence board for the left elevator. Position assembly of the plate and board on the black painted marks on the left horizontal stabilizer.

(6) Make sure that the left elevator trailing edge is aligned with the neutral mark of rigging plate. If necessary, adjust the connecting rod between the quadrant and the left elevator operating lever to align the trailing edge with the neutral mark. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

(7) Re-assemble the rigging plate and incidence board for the right elevator. Position the assembly of the plate and board on the black painted marks on the right horizontal stabilizer.


2·5 IN.
AFT TRIM CHAINS
(LEFT SIDE SHOWN RIGHT SIDE SIMILAR)
O
N
14B
AFT TRIM CHAINS
13B
TRIM JACK
NOTE
DETAILS OF TRIM CHAIN AND JACK SHOW FULL NOSE DOWN POSITION
11·0 IN.
L
M
POSITION TENSIOMETER MIDWAY BETWEEN PULLEYS I AND J
CONDUITS
0·27 IN.
Fr. 19
K
Fr. 16
J
Fr. 14
RIGGING FACE
Fr. 11
I
H
G
FORWARD TRIM CHAIN
F
E
D
C
B
A
CONTROL PEDESTAL CHAIN (ENDLESS LOOP)
NOTE
DETAILS ARE AS VIEWED FROM REAR TO FRONT
TRIM JACK
A
B
C
D
E
F
G
14A
13A
H
I
J
K
L
M
N
O
3417/2
M15496
HA00B98109AA

Elevator trim control system rigging

*Figure 503*

(8) Make sure that the right elevator trailing edge is aligned with the neutral mark of the rigging plate. If necessary, adjust the connecting rod between the quadrant and the right elevator operating lever to align the trailing edge with the neutral mark. Make sure that the rod ends are in safety, tighten the locknuts and lockwire.

(9) Remove the rigging pins from the elevator pulley drum under the flight compartment floor, the elliptical pulley drum in the rear equipment bay, and the quadrant mounted under the horizontal stabilizer.

(10) Do a check of the elevator range of movement (Paragraph 6.C).

(11) Functionally test the elevator control system, (Paragraph 4)

## 2. Rig elevator trim control system *(Figure 502, Figure 503,* and *Figure 505).*

### A. Procedure

(1) In the control pedestal:
Do a check of the endless loop of chain for adequate tension. If it is necessary to alter the chain tension, adjust the jockey arm position by tightening or slackening the nut on the adjuster. Lockwire the nut after the adjustment.

(2) Operate the elevator trim handwheel to full NOSE DOWN position, on the stops.

(3) Make sure that the upper end of the forward trim chain is at the correct position as shown. The dimension is measured to the centre of the hole in the chain connector. If chain is incorrectly disposed, remove the chain guards from the sprocket bracket and trim servo mounting (ELEVATOR TRIM TAB SERVO MOUNTING). Correct the chain disposition to suit dimension. Install the cable guards to the sprocket bracket and trim servo mounting. Tighten the stiffnuts.

(4) Adjust the turnbuckles connecting the forward trim chain to cable ends 13A and 14A and make sure that the turnbuckles are in safety, tighten the locknuts and wire lock.

(5) Make sure the aft trim chains are disposed about the sprockets as shown. If aft trim chains are incorrectly disposed about the sprockets, adjust the turnbuckles connecting the chains to the cable ends 13B and 14B and balance cable.

(6) Set the tensiometer for 5 cwt cable and position as shown. Tension the cables to between 25 and 30 lb. Make sure that the turnbuckles are in safety, tighten the locknuts and lockwire.

(7) Make sure that the left and right trim jacks are at the nose down position, when, the corners of the nuts on the fork ends are at the position shown.

*NOTE: If the trim jack is not at the nose down position, it must be removed and installed to allow the relationship of the trim jack fork end position to the aft trim chain disposition to be corrected (ELEVATOR TRIM JACK).*

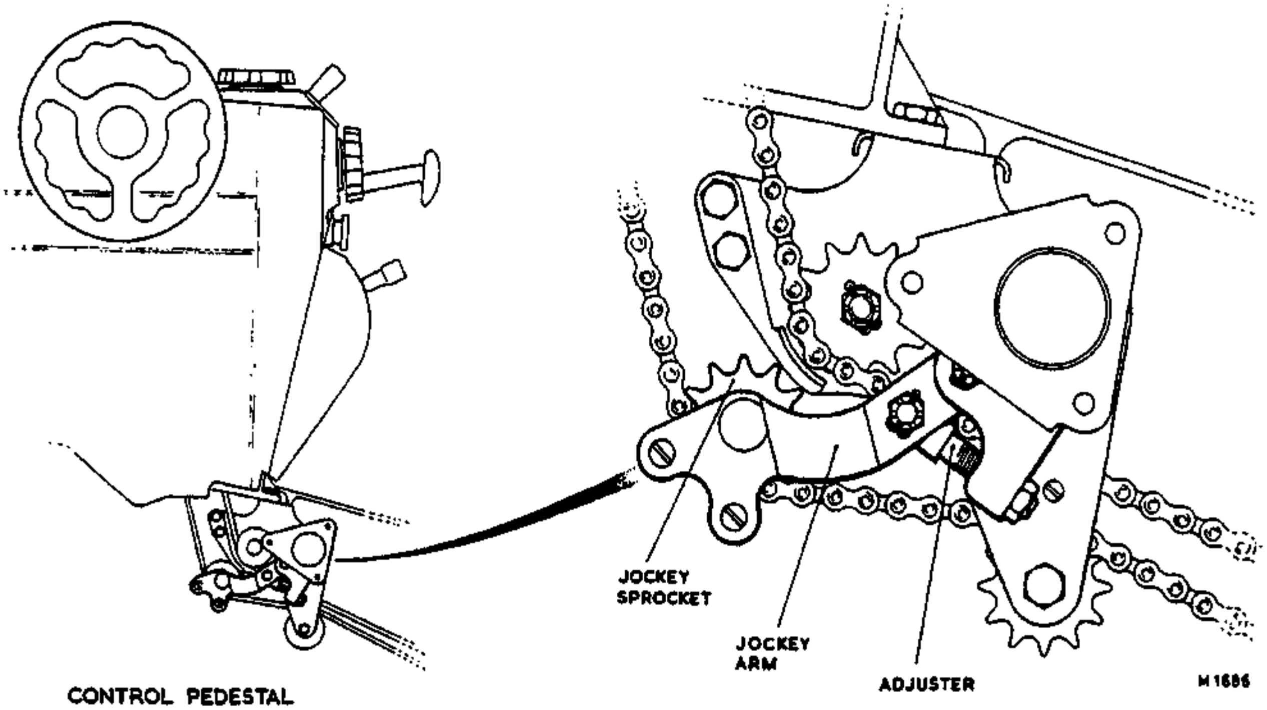
(8) Set the elevator to its neutral position, and insert a rigging pin through the rigging pin holes in the quadrant and its mounting.

(9) Make sure that the trim tabs are at the nose down trim position. If necessary, adjust the trim tabs to the nose down trim position (Paragraph 3.).

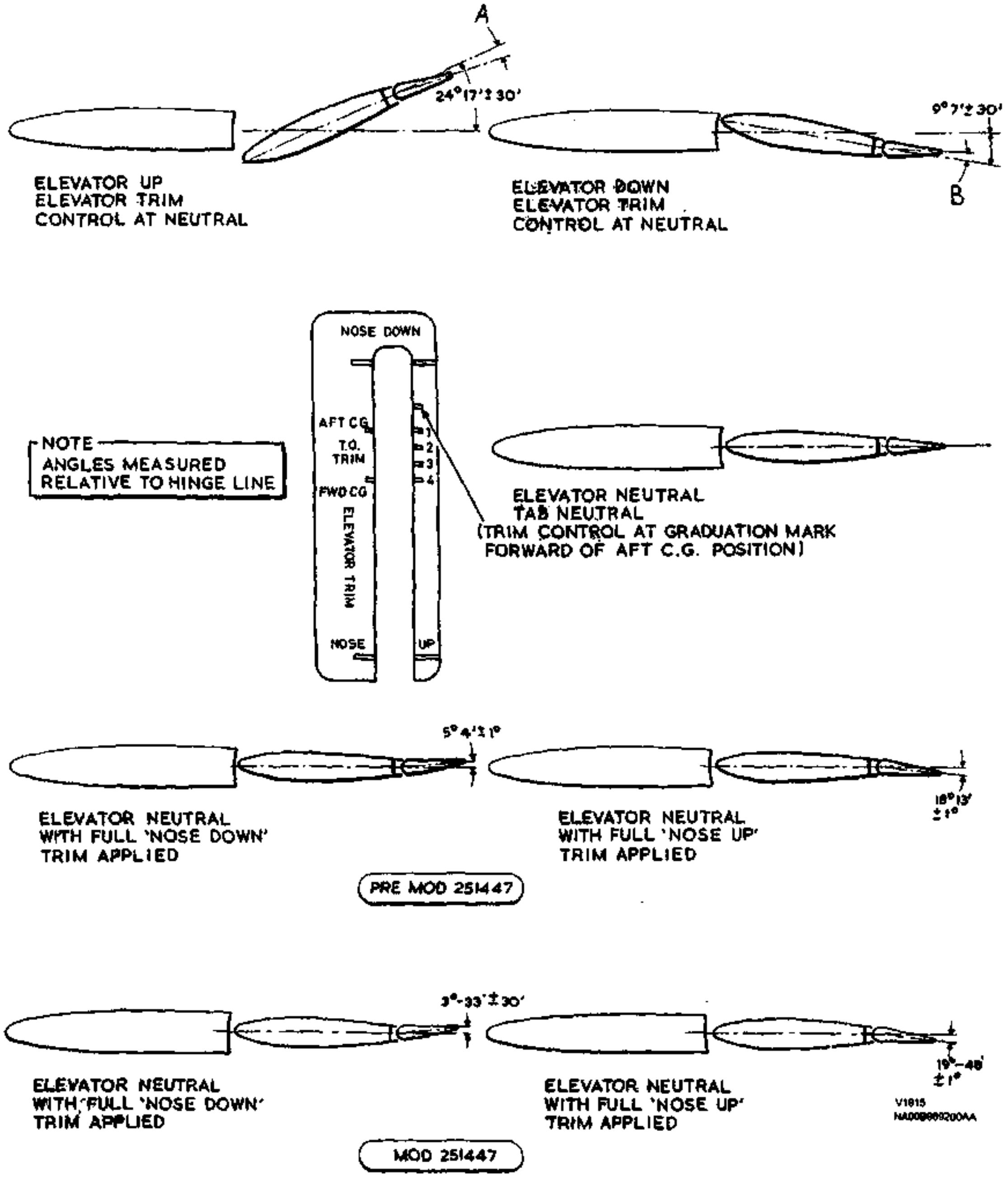
(10) Remove the rigging pin from the quadrant and its mounting.

(11) Do a check of the elevator trim tab for range of movement (Paragraph 6.D).

(12) Functionally test the elevator trim control system (Paragraph 5.).



Jockey sprocket adjustment
*Figure 504*



Elevator and elevator tab - movements
*Figure 505*

## 3. Adjust trim tab to nose down trim position

### A. Procedure *(Figure 502 and Figure 505)*

(1) Disconnect the rods from the trim tab.

(2) Do a check, and record the elevator control circuit static friction (Paragraph 6.E).

(3) Make sure that the force required to operate the elevator trim handwheel from stop to stop is not excessive (Paragraph 6.F).

*NOTE: During paragraphs (2) and (3) make sure that the trim tab connecting rods do not foul any structure.*

(4) Secure the connecting rods to the trim tab with the bolts, washers and nuts.

(5) Set the elevator to the neutral position and insert a rigging pin through the rigging pin holes in the quadrant and its mounting.

(6) Adjust the trim tab connecting rods in unison to set the tab to a nose down trim position. The adjusted length of one rod must not tend to compress or tension the other rod. Drain holes in the connecting rods must be positioned to within 25° of the rod vertical centre line. Do a check for free movement (backlash) of the elevator trim tab, (Paragraph 6.G).

(7) Remove the rigging pin from the quadrant and its mounting.

(8) Do a check of the elevator control circuit static friction, refer to paragraph 6.E. If there is any increase in the static friction from that measured in paragraph (2), the increase must be relieved by making sure that there is no tendency for one trim tab connecting rod to compress or tension the other rod. Similarly, reduce any increase in the force required to operate the elevator trim handwheel.

(9) Make sure the ends of the trim tab connecting rods are in safety, tighten the locknuts and lockwire.

## 4. Do a functional test of the elevator control system

### A. Procedure *(Figure 501)*

(1) Use an inclinometer to set the control column to a neutral position. Make sure that the left and right elevator horns are aligned with the horizontal stabilizer.

(2) Operate the control column through its full range and make sure that the elevators move in the correct sense. Do a check of the elevators for full and free movement, make sure that the range of movement is limited by the primary stops.

(3) Put the trim full NOSE DOWN with the elevator trim handwheel. Operate the control column and do a check of the elevators for full and free movement.

(4) Put the trim full NOSE UP with the elevator trim handwheel. Operate the control column and do a check of the elevators for full and free movement.

*NOTE: During the above movements make sure that at all positions of travel the minimum clearance between the G-weight nuts and bolts and the G-weight guard is not less than 0.35 in.*

## 5. Do a functional test of the elevator trim control system

### A. Procedure

(1) Operate the elevator trim handwheel over its full range from stop to stop; make sure that the pointer moves over the full scale, and that the pointer and the trim tab move in the correct sense.

(2) Operate the control column to align the elevator horns with the horizontal stabilizer, and operate the elevator trim handwheel to set the pointer at the mark forward of AFT CG position; make sure the elevator and trim tab trailing edges are aligned.

(3) Operate the control column to apply full up elevator, and do a check of the elevator trim handwheel for full and free operation between stops.

(4) Operate the control column to apply full down elevator, and do a check of the elevator trim handwheel for full and free operation between stops.

## 6. Rigging, range of movement and friction checks

### A. Do a check of the elevator control system rigging *(Figure 501 and Figure 505)*

(1) Insert a rigging pin through the rigging pin holes in the elevator pulley drum and its mounting under the flight compartment floor.

(2) Make sure that the rigging faces on the elevator bellcrank and its mounting are aligned.

(3) Use an inclinometer to make sure that the left and right control columns are at their neutral position.

(4) Make sure that the rigging marks on the G weight arm and rigging plate are aligned.

(5) Set the tensiometer for 25 cwt cables, and at the position shown, make sure that the cable tension is between 70 lb. and 80 lb.

(6) Insert a rigging pin through the circular and elliptical pulley drum and its mounting.

(7) Insert a rigging pin through the quadrant and its mounting.

(8) Set the tensiometer for 25 cwt cable. Position the tensiometer on cable coded No.7 midway between the elliptical pulley drum and the turnbuckles connecting cable ends 7B-7B; make sure that the cable tension is between 85 lb. and 95 lb. Position the tensiometer on cable coded No.8 midway between the upper end of the swaged tube and the pulleys located at frame 23; make sure that the cable tension is between 85 lb. and 95 lb.

(9) Assemble the rigging plate to the incidence board for the left elevator. Position the assembly of plate and board on the black painted marks on the left horizontal stabilizer. Make sure that the left elevator trailing edge aligns with the plate neutral mark.

(10) Re-assemble the rigging plate and incidence board for the right elevator. Position the assembly of plate and board on the black painted marks on the right horizontal stabilizer. Make sure that the right elevator trailing edge aligns with the plate neutral mark.

(11) Remove the rigging pin from the elevator pulley drum under the flight compartment floor, the elliptical pulley drum in the rear equipment bay, and the quadrant mounted under the horizontal stabilizer.

(12) Remove rigging plate and incidence board from the airplane.

**B. Do a check of the elevator trim control system rigging** *(Figure 503, Figure 504 and Figure 505).*

(1) Operate the elevator trim handwheel to the full NOSE DOWN position, on the stops.

(2) Make sure that the endless loop of chain in the control pedestal has the correct tension.

(3) Make sure that the upper end of the forward trim chain is positioned as shown.

(4) Set the tensiometer for 5 cwt cable, and at the position shown, make sure that the tension of the forward cables is between 25lb and 30 lb.

(5) Make sure that the aft trim chains are positioned on the sprockets, as shown.

(6) Set the tensiometer for 5 cwt cable, and at the position shown, make sure that the tension of the rear cables is between 25lb and 30 lb.

(7) Assemble the rigging plate and incidence board for the left elevator. Position the assembly of the plate and board on the black marks on the left horizontal stabilizer. Align the left elevator trailing edge with the plate neutral mark, and make sure that the left trim tab is at the nose down trim position.

(8) Re-assemble the rigging plate and incidence board for the right elevator. Position the assembly of the plate and board on the black marks on the right horizontal stabilizer. Align the right elevator trailing edge with the plate neutral mark, and make sure that the right trim tab is at the nose down trim position.

(9) Remove the assembly of rigging plate and incidence board from the airplane.

**C. Do a check of the elevator range of movement** *(Figure 501)*

(1) Assemble the rigging plate to the incidence board for the left elevator. Position the assembly of the plate and board on the black marks on the left horizontal stabilizer.

(2) Operate the control column through its full range. Make sure that when the elevator movement is limited by the primary stops, the elevator trailing edge lies within the limits of the rigging plate graduations at the up and down positions.

(3) Re-assemble the rigging plate and incidence board for the right elevator. Position the assembly of the plate and board on the black marks on the right horizontal stabilizer.

(4) Operate the control column through its full range. Make sure that when the elevator movement is limited by the primary stops, the elevator trailing edge lies within the limits of the rigging plate graduations at the up and down positions.

*NOTE: It is not anticipated that the stops will require adjustment, but should this be necessary refer to ELEVATOR.*

(5) Remove the assembly of rigging plate and incidence board from the airplane.

(6) Make sure that the clearances at the elevator secondary stops at the forward elevator pulley drum are as follows:

  (a) With the elevator in fully up position - 0.12 in. ±0.01 in.

  (b) With the elevator in fully down position - 0.04 in. ±0.01 in.

(7) Adjust the washers under the stop pads as necessary; secure the stop pads with cotter pins

**D. Do a check of the elevator trim tab range of movement** *(Figure 505)*

(1) Assemble the rigging plate and incidence board for the left elevator. Position the assembly of the plate and board on the black marks on the left horizontal stabilizer.

(2) Align the left elevator trailing edge with the plate neutral mark. Operate the elevator trim handwheel over its full range between stops, and make sure that the left trim tab movement is within the limits shown.

(3) Re-assemble the rigging plate and incidence board for the right elevator, and position the assembly of the plate and board on the black marks on the right horizontal stabilizer.

(4) Align the right elevator trailing edge with the plate neutral mark. Operate the elevator trim handwheel over its full range between stops, and make sure that the left trim tab movement is within the limits shown.

(5) Remove the assembly of rigging plate and incidence board from the airplane.

(6) With the elevator trim pointer at graduation mark forward of AFT CG position, operate the elevators through the full range permitted by the primary stops. Record the actual total elevator movement, and angles A and B for the trim tab.

(7) Use the information recorded in paragraph (6), and do a check of the left trim tab movement to the formula:

$$\frac{A + B}{\text{total elevator movement}} = 0.085 \pm 0.03$$

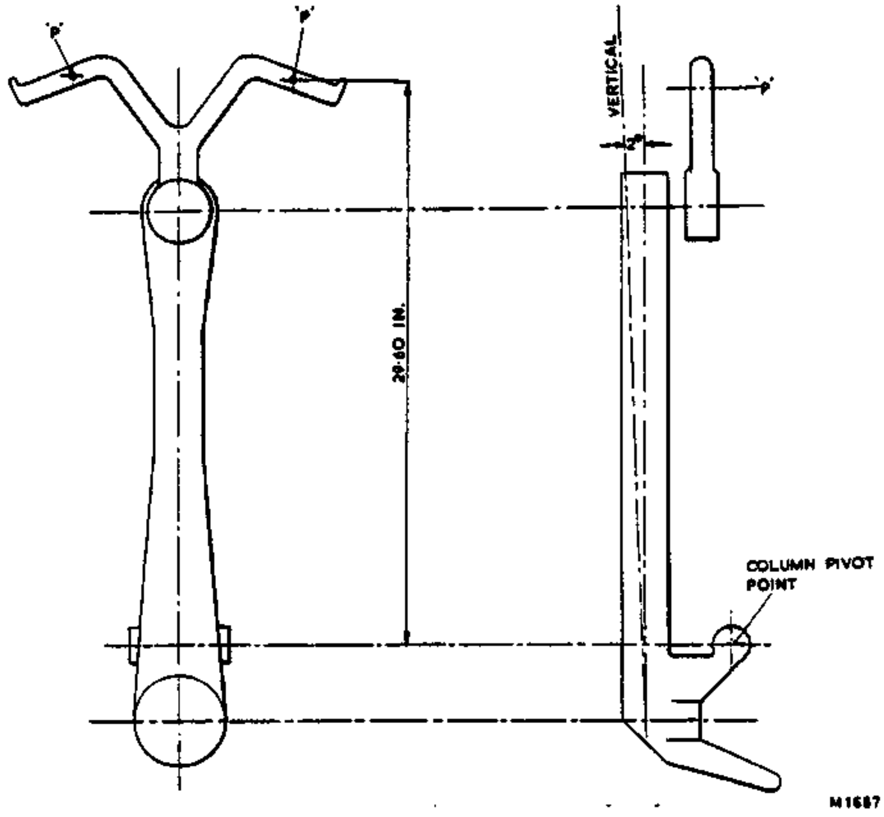
(8) Repeat paragraphs (6) and (7) for the right elevator and trim tab.

**E. Do a check of the elevator control circuit static friction** *(Figure 506)*

(1) Do this check with the circuit rigged and complete, including the elevators and tabs, G weight and spring, and the autopilot.

(2) Use a spring balance to measure the load required to operate the control column; put the load on a line normal to the control column handwheel at point P, as shown.

(3) Record the loads required to operate the column to raise and lower the elevators. Starting from fully forward, the stick forces must be measured with the control column at the angles and be within the limits given in *Table 501*.



Elevator control circuit static friction
*Figure 506*

*NOTE: If all readings are high, this shows that either the balance spring effect is low or the G weight is heavy.*

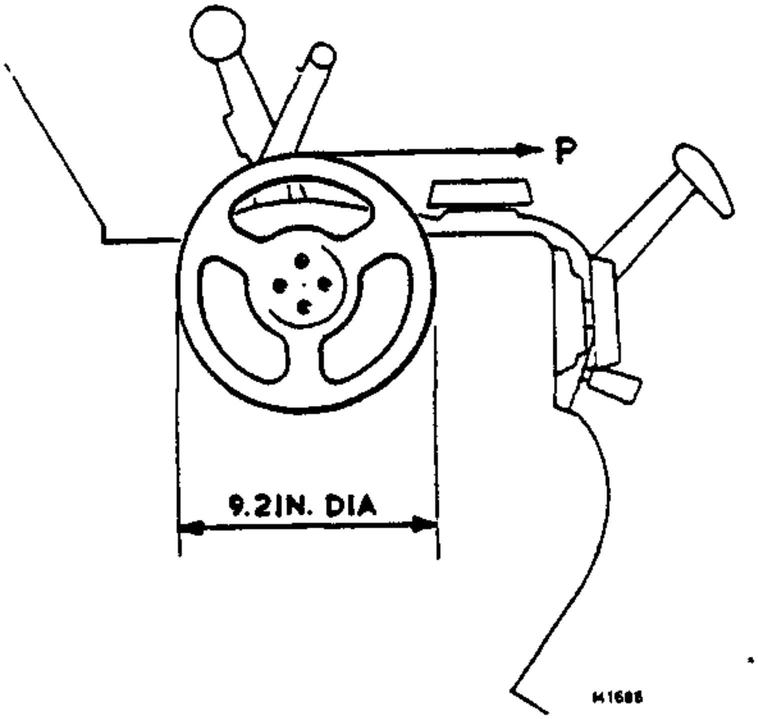
*NOTE: If all readings are low, this shows that the balance spring effect is high or G weight is light.*

*NOTE: If difference between pairs of readings is large, this indicates circuit friction is high.*

**F. Do a check of the elevator trim control circuit static friction** *(Figure 507)*

(1) Do this check with the trim circuit rigged and complete, including the elevators and tabs.

(2) Use a spring balance to measure the load required to operate the elevator trim handwheel; apply a tangential load P to the rim of the handwheel as shown..



Elevator trim control circuit static friction
*Figure 507*

Control column loads
*Table 501*

| Control Column Angle | MEASURED AT POINT P *(Figure 506)* | |
|---|---|---|
| | Maximum force pulling (lb.) | Minimum force releasing (lb.) |
| Fully forward | 15¼ | 7¼ |
| 5° forward | 15 | 8½ |
| 0° (Neutral) | 15¾ | 9¾ |
| 5° | 17½ | 10½ |
| 10° | 19 | 11¼ |
| 15° | 20¾ | 12 |
| Fully Aft | 22¾ | 12½ |

(3) Record the loads required to operate the handwheel through its full range in both directions of operation. The maximum permissible load at any point is 3 lb. with Collins autopilot

**G. Do a check for free movement of the elevator and elevator tab**

(1) Make sure that no movement of the quadrant occurs while the free movement of the elevator is being measured.

(2) Use an inclinometer to measure free movement of the elevator; the maximum permissible free movement is 0 degrees 30 minutes.

(3) Make sure that no pivotal movement of the elevator occurs while the free movement of the trim tabs is being measured.

(4) Disconnect one connecting rod from tab; check that the free movement (backlash) measured at the tab trailing edge does not exceed 0.06 in. Install and secure the connecting rod and disconnect the other rod; repeat the backlash check. Install and secure the connecting rod to the tab. Tighten the nuts and lock with split pins.

# ELEVATOR - MAINTENANCE PRACTICES

## 1.Unit servicing

### A.Lubrication

For routine lubrication data, refer to Maintenance Schedule.

## 2.Removal/Installation (Fig.201)

CAUTION : DO NOT STRAIN OR DAMAGE TAB CONNECTING ROD EYE ENDS OR OPERATING LEVERS AS SUBSEQUENT FRACTURE MAY OCCUR. DO NOT USE EXCESSIVE FORCE WHEN REMOVING TAB ROD CONNECTING BOLTS.

Equipment and materials required :-

| | |
|---|---|
| Rigging pin set .. .. | BAe 25-7Y15A |
| Rigging plate .. .. | BAe 25Y73A |
| Incidence board .. .. | BAe 25Y195A |
| Jointing compound JC5A .. | DTD 900/4488 |
| Grease, low temperature .. | DTD 5598 |
| Grease, MX-33 (pre mod.25/2348) | DTD 900/4630 |

### A.Remove elevator (left or right)

(1) On panel DA/E, trip NAV and ROTATING BEACON light circuit breakers (grid refs. C11 and C12) (see Chapter 24, GENERAL).

(2) Remove cover plate from left side of bullet fairing, above horizontal stabilizer. Disconnect leads from terminal block HE, mounted inside bullet fairing.

(3) Remove bolts and withdraw bullet fairing from vertical stabilizer, ensuring that electrical cables slide clear of fairing.

(4) Remove insert fairing from aft end of fixed fairing on elevator. Remove fairings from trim tab, and centre and outboard hinges.

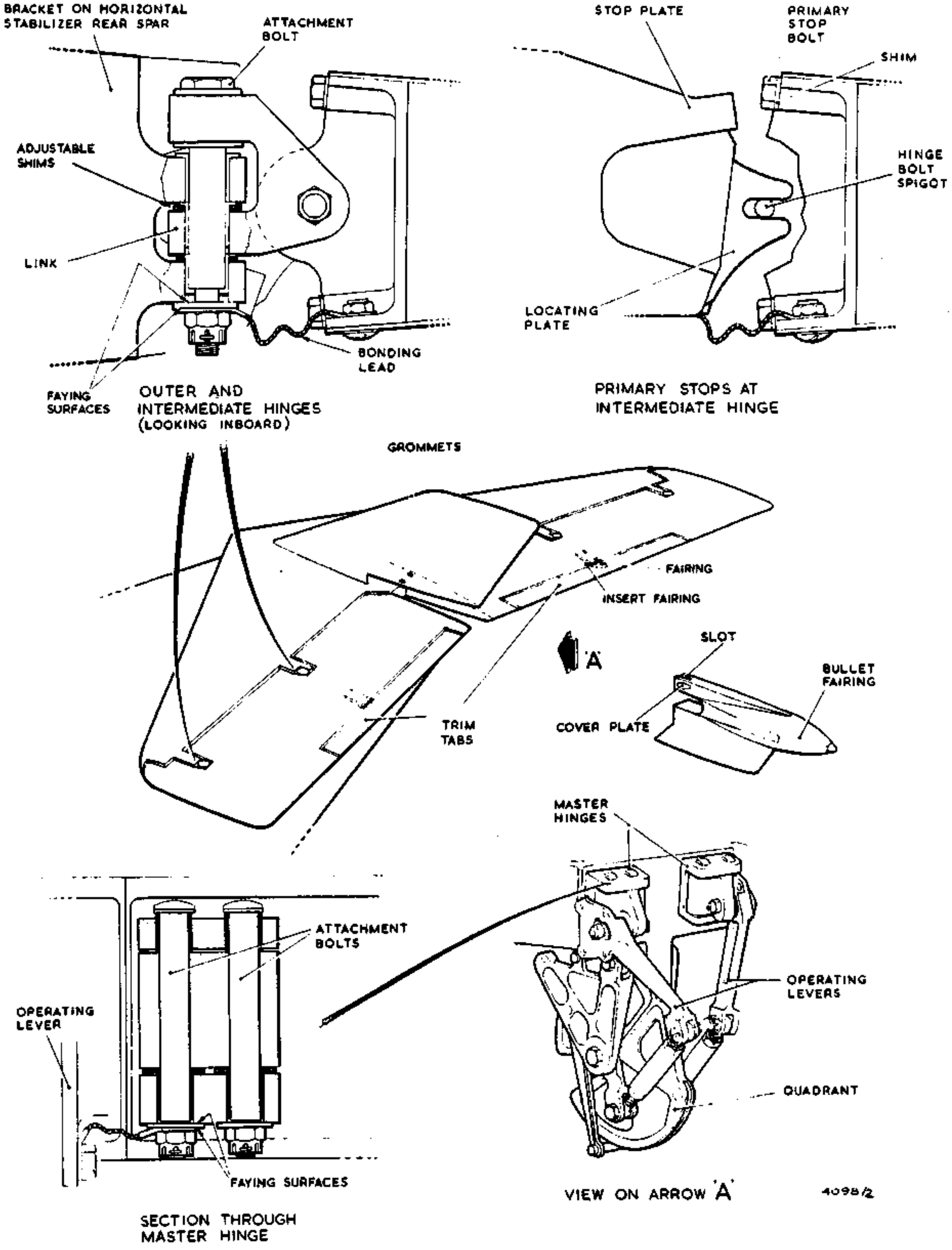
(5) Detach connecting rods from trim tab.

NOTE : Do not misalign rod bearings more than 6° or the seals may be damaged.

(6) Detach connecting rod from operating lever. Turn and push bolt to clear circlip in operating lever.

(7) Remove grommets from forward end of bottom rib of upper vertical stabilizer. Removal of grommets allows attachment bolts at master hinge to be withdrawn.

(8) Support elevator, and remove attachment bolts from links, and from brackets on horizontal stabilizer rear spar. Detach bonding leads from attachment bolts during removal.



Elevator installation
Fig.201

(9) Remove elevator from horizontal stabilizer, guiding trim tab connecting rods clear of structure.

(10) If applicable, remove static discharge probes (see Chapter 23, STATIC DISCHARGING).

B. Checks/Tests before installation

(1) Before fitting an elevator, ensure that if the elevator has been repaired, painted, or if a new tab has been fitted, it has also been re-balanced. Refer to the STRUCTURAL REPAIR MANUAL - Chapter 55 for information on re-balancing.

C. Installation elevator (left or right)

NOTE : Operations (3) to (5) are only necessary when a new or overhauled elevator is being installed. Operations (1), (2), (6) and subsequent apply if the existing elevator is being refitted.

(1) Operate elevator trim control to NOSE DOWN position, and check that trim jack is at NOSE DOWN trim position, refer to Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS.

(2) If detached, secure trim tab connecting-rods to trim jack, refer to Chapter 27, TRIM JACK.

(3) Position elevator behind horizontal stabilizer, pass trim tab connecting rods through elevator, and fit links into brackets on horizontal stabilizer rear spar; support elevator during operation (4).

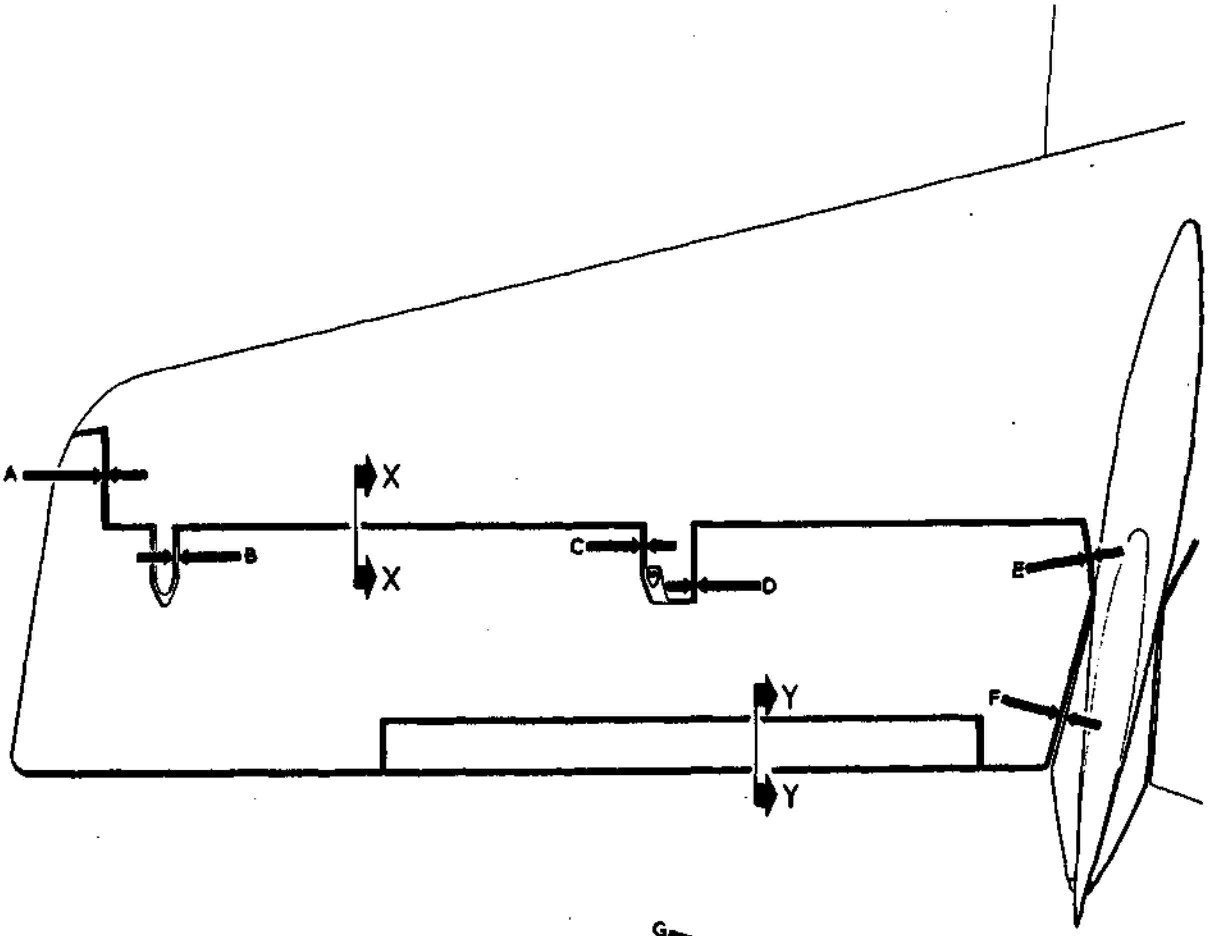
(4) Ascertain if there is any vertical movement of the elevator in relation to the horizontal stabilizer at outer and intermediate hinges. Use feeler gauges to measure any gap between the top face of flanged bushes in links and brackets on horizontal stabilizer. If necessary, remove flanged bushes from links and adjust shimming to eliminate gap. Smear shims and exterior of bushes with jointing compound; position shims on bushes and fit bushes into links.

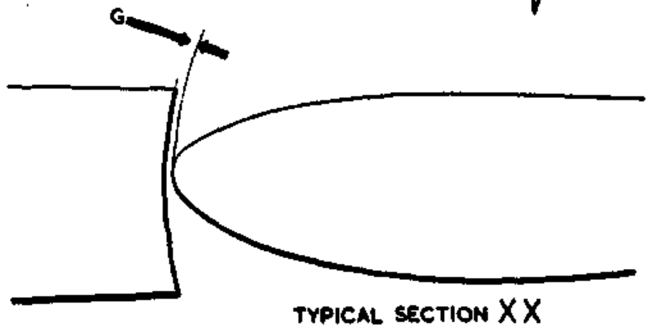
CAUTION : DO NOT DISTURB SHIMMING OF BUSHES IN BRACKET ON HORIZONTAL STABILIZER; THESE SHIMS ARE JIG ADJUSTED.

(5) Remove elevator from horizontal stabilizer, guiding trim tab connecting rods clear of structure.

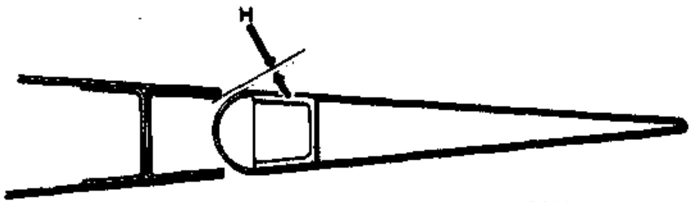
(6) Smear shanks of attachment bolts with grease, low temperature (Mod.25/2348) or grease, MX 33 (pre mod.25/2348); smear jointing compound under bolt heads, washers and nuts.

(7) Effect DHS 645, (see Chapter 20) on faying surfaces of hinge brackets, washers and bonding leads at each hinge, see Fig.201.





TYPICAL SECTION XX



TYPICAL SECTION YY

| | MAXIMUM | NOMINAL | MINIMUM |
|---|---|---|---|
| A | 0·20 in. | 0·15 in. | 0·10 in. |
| B | 0·40 in. | 0·28 in. | 0·20 in. |
| C | 0·20 in. | 0·15 in. | 0·10 in. |
| D | 0·45 in. | 0·40 in. | 0·35 in. |
| E | 0·30 in. | 0·25 in. | 0·20 in. |
| F | 0·365 in. | 0·29 in. | 0·215 in. |
| G | 0·20 in. | 0·15 in. | 0·10 in. |
| H | 0·13 in. | | 0·05 in. |

Elevator and elevator tab - clearances
Fig.202

...Elevator - Maintenance practices continued

(8) Position elevator behind horizontal stabilizer, pass trim tab connecting rods through elevator, and fit links into brackets on horizontal stabilizer rear spar; support elevator and insert attachment bolts.

NOTE : When link of intermediate hinge enters bracket on rear spar, check that spigot of hinge bolt enters slot in locating plate.

(9) Secure bonding leads to brackets with attachment bolts. Fit washers and nuts to attachment bolts. Tighten nuts to a torque load of 90-110 lb.in. and lock with split pins. Fit centre and outboard hinge fairings.

NOTE : With the bolts fully tightened, there should still be a clearance under attachment bolt heads of outer and intermediate hinges; at master hinges, attachment bolt heads clamp sliding bushes in brackets.

(10) Fit grommets into two holes in bottom rib of upper vertical stabilizer.

(11) Secure trim tab connecting rods to trim tab with bolts, washers, and nuts; lock nuts with split pins.

(12) Secure insert fairing to aft end of fixed fairing on elevator with washers and bolts.

(13) Examine Thiokol seal on fairing (removed from trim tab). If necessary, remove existing Thiokol, and make a new Thiokol seal 0.03 in. thick in accordance with DHA 447, Method 1 (see Chapter 20). Secure fairing to trim tab with bolts.

(14) Secure connecting rod to operating lever with bolt, washer and nut; lock nut with split pin.

NOTE : Ensure that bolt engages circlip in operating lever.

(15) Insert rigging pin through rigging pin holes in elevator quadrant and its mounting.

(16) Assemble rigging plate and board to suit relevant elevator, and position assembly on black painted marks on horizontal stabilizer. Check that elevator trailing edge aligns with rigging plate neutral mark. If necessary, adjust connecting rod between elevator quadrant and operating lever to align trailing edge with neutral mark. Check that ends of rod are in safety, tighten locknuts and wire-lock.

(17) Check that trim tab is at nose down position and adjust as necessary (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(18) Remove rigging pin from quadrant.

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(19) Check elevator and elevator trim tab ranges of movement (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(20) Functionally test elevator and elevator trim control systems (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(21) If it is necessary to correct the elevator range of movement, adjust shims of primary stops at intermediate hinge. Wire-lock stop bolts after adjustment.

NOTE : Prior to making the above adjustments, ensure there is adequate clearance at the secondary stops; on completion, reset the secondary stop clearances (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(22) Suitably position bullet fairing, and locate electrical cables in slot. Position bullet fairing on vertical stabilizer, and secure with mushroom head bolts, ensuring that the special bolts are fitted to the top forward edge, left and right.

(23) Connect electrical cables to terminal block HE, inside bullet fairing.

(24) Reset NAV and BEACON circuit breakers (see Chapter 24, GENERAL).

(25) Functionally test navigation and anti-collision beacon lamps (see Chapter 33, EXTERIOR LIGHTS).

(26) Secure access panel to bullet fairing with bolts.

(27) Check clearances shown on Fig.202.

(28) Functionally test elevator and elevator trim control systems (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(29) If applicable, fit static discharge probes (see Chapter 23, STATIC DISCHARGING).

(30) Check electrical bonding of elevator to aircraft (see Chapter 20, DHS 645).

(31) Check free movement of elevator and elevator trim tab (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

* * *

# ELEVATOR MASS BALANCE ASSEMBLY - INSPECTION/CHECK

## 1. Examine the mass balance assembly *(Figure 601)*

### A. Procedure

| Equipment/Materials | Part/Item No. |
|---|---|
| Primer, low volatile organic compound | 469 (Chapter 20-95-401) |
| Sealant | 317 (Chapter 20-95-301) |
| Compound, sealing putty | 326 (Chapter 20-95-301) |

(1) Disengage the control lock and move the elevator to give access to the side plate.

(2) Remove and keep the bolts that attach the side plate to the elevator balance weight. Remove the side plate.

(3) Examine the side plate and anchor nuts for corrosion. If corrosion is found, replace as necessary.

(4) Examine the surface finish of the side plate to make sure that there is no damage to the surface protection layer. Clean and apply a layer of primer (Item 469) as necessary.

(5) Install serviceable or new anchor nuts and apply a layer of sealant (Item 317).

(6) Remove the split pin, castellated nut, washer, distance bush and balance weights from the balance weight spigot. Record the position of the weights as they are removed to help with reassembly to the correct elevator.

(7) Examine the balance weight spigot for corrosion at the surface area that is touched by the balance weights.

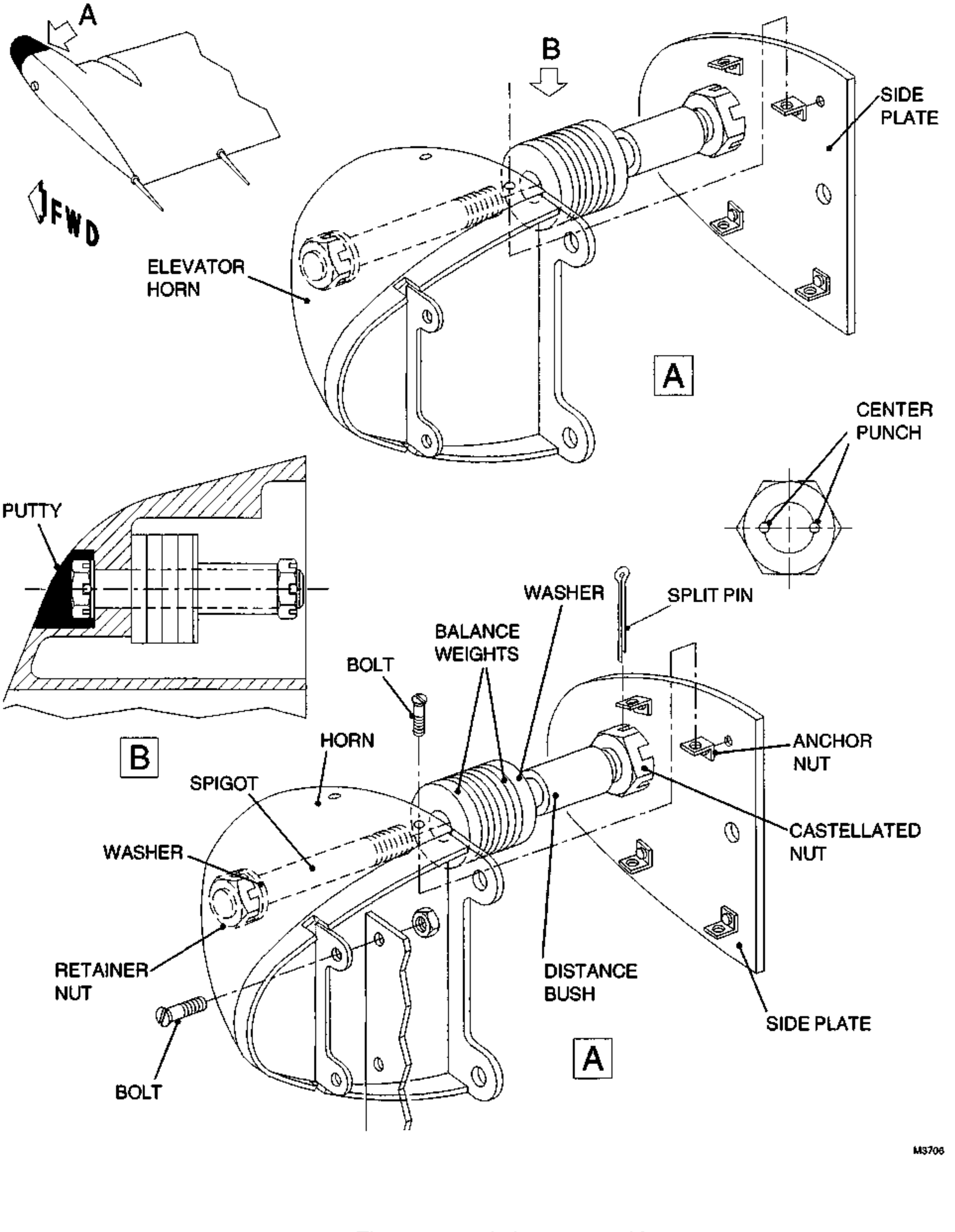
*NOTE: Remove all corrosion found from the spigot with fine abrasive cloth to a maximum depth of 0.03 in. and apply a layer of primer (Item 469). If there is too much corrosion, contact: Product Support, Raytheon Aircraft Company.*

(8) Apply a layer of primer (Item 469) to the components and assemble the balance weight spigot and balance weights. When the assembly is completed, tighten the castellated nut and install the split pin.

*NOTE: If the spigot has been replaced, lock the retainer nut into position with a center punch in two places.*

(9) Install the side plate assembly to the elevator and apply a layer of sealant (Item 317) to minimize possible further corrosion. Apply a layer of primer (Item 469) to make a good external finish. Seal the recess with putty (Item 326).

(10) Engage the control locks.



Elevator mass balance assembly

*Figure 601*

# ELEVATOR TRIM JACK - MAINTENANCE PRACTICES

## 1. Unit servicing

### A. Lubrication

For routine lubrication data, refer to the Maintenance Schedule.

## 2. Removal/Installation (Fig.201)

Materials required :

| | |
|---|---|
| Grease, low temperature | DTD 844, 866 or 5598 |
| Grease, MX-33 (pre Mod.25/2728) | DTD 900/4630 |
| Jointing compound JC5A | DTD 900/4488 |

### A. Remove trim jack, left or right

CAUTION : TRIM JACKS ARE INDIVIDUALLY ADJUSTED ON INSTALLATION, AND ARE NOT INTERCHANGEABLE. LABEL TRIM JACK FOR IDENTIFICATION.

(1) Remove relevant elevator (see Chapter 27, ELEVATOR).

(2) Operate elevator trim control to NOSE DOWN position, on stops.

(3) Remove access plate from structure enclosing trim jack.

(4) To prevent movement of torque shaft due to cable tension, temporarily secure shaft to adjacent structure with cord.

(5) Support trim jack. Remove bolts securing housing to riblet and mounting plate to stop plate. Remove trim jack and retain shim.

(6) Operate trim jack and extend fork-ends; detach connecting rods from fork-ends. Refit bolts and nuts to fork-ends.

NOTE : Do not extend fork-ends more than necessary for access to bolts, or fork-ends will become disengaged from jack.

Do not misalign rod bearings more than 6° or seals may be damaged.

(7) Remove mounting plate from trim jack; retain screws and washers.

### B. Install trim jack

NOTE : Due to non-interchangeability, it is only permissible to install a trim jack with an undrilled end-cap, or the jack which was previously in this position. For the latter, the procedure ends at operation (9).

(1) Coat screws and washers with jointing compound; position washers between mounting plate and trim jack, and secure plate to trim jack with screws.

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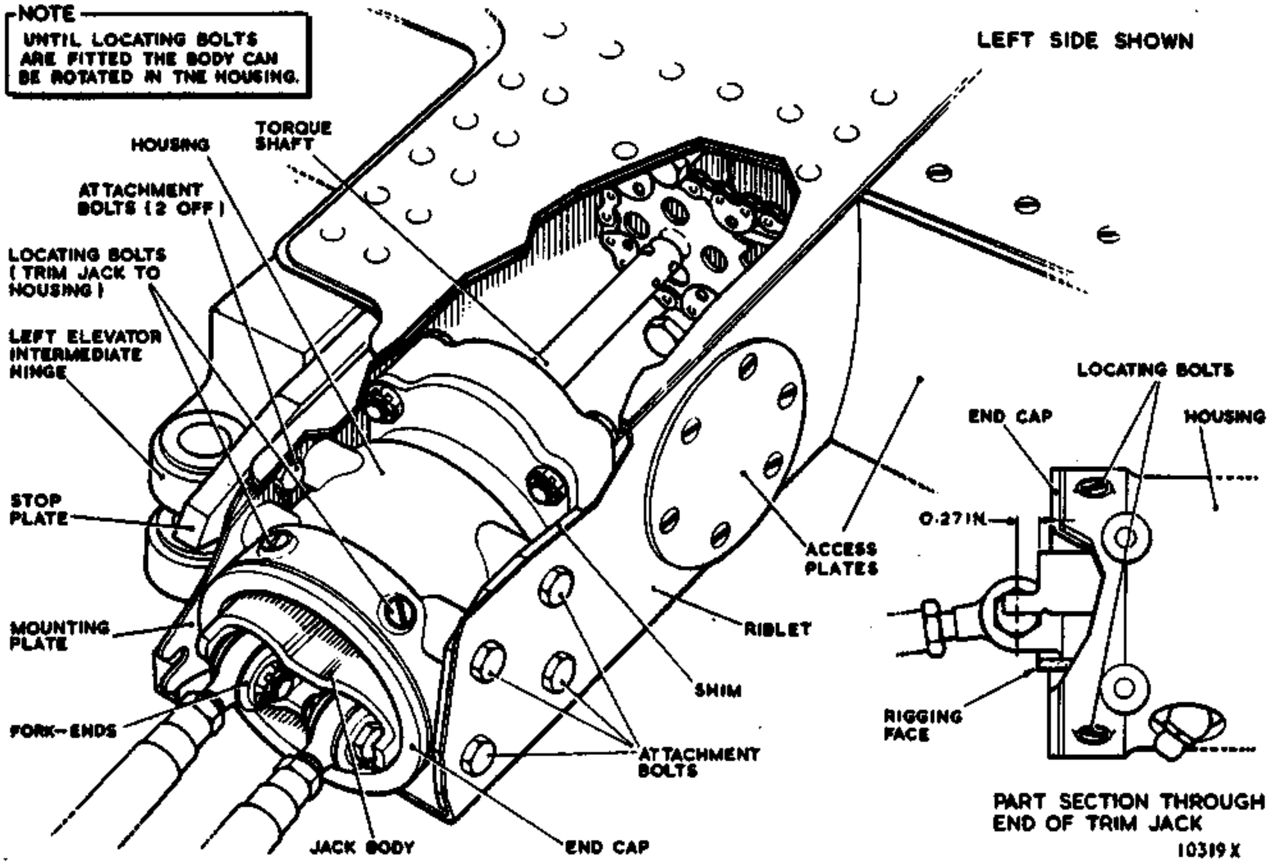
...Elevator trim jack - Maintenance practices continued

(2) Operate trim jack and extend fork-ends; remove bolts and nuts supplied with jack.

NOTE : Do not extend fork-ends more than necessary for access to bolts, or fork-ends will become disengaged from jack.

(3) Attach connecting rods to fork-ends with bolts and nuts supplied with jack, lock bolts with split pins, ensuring that the following conditions are met :-

(a) Care must be exercised when entering rod eye-end into fork-end; if the inner race is tilted more than 6° the seals may be damaged.
(b) That nuts butt against shoulders on fork-ends.
(c) Split pins are fitted in line with axis of fork-end movement.
(d) Drain holes, if incorporated, are at bottom and within 25° of vertical centre line.



Trim jack installation
Fig.201

...Elevator trim jack - Maintenance practices continued

(4) Check that elevator trim control is at NOSE DOWN position on stops.

NOTE : If the trim circuit is disconnected, check the disposition of the chains on the horizontal stabilizer rear spar (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(5) Operate trim jack to set fork-ends at position shown on Fig.201.

NOTE : When rods are assembled to trim jack, dimension can be measured from corners of nuts to rigging face.

(6) Smear trim jack serrated shaft with grease, low temperature.

(7) Position trim jack in box structure on horizontal stabilizer rear spar, with shim positioned as shown on Fig.201. Engage torque shaft with trim jack. Coat bolts with jointing compound and secure jack to riblet, and mounting plate to stop plate with bolts; wire-lock together heads of bolts securing mounting plate to stop plate.

(8) Install elevator (see Chapter 27, ELEVATOR).

NOTE : If a trim jack with an undrilled end-cap is being installed, the elevator and trim tab movements cannot be finally checked until the locating bolts are fitted. However, during operations (10) and (11), it is essential that the full and free movement is not curtailed.

(9) Lubricate trim jack through the two nipples with grease, MX-33 (pre Mod. 25/2728) or DTD 5598 (Mod.25/2728).

NOTE : These two greases must not be mixed.

(10) To prevent trim jack operating effort increasing at extremes of elevator movement, it is essential that centres of fork-ends lie on a line parallel to the elevator hinge line. To achieve the required condition, make small rotational adjustments to the position of the jack body in the housing; clamp the body after each adjustment to prevent unintentional rotation.

(11) After each adjustment, check the trim jack operating effort over the full trim range, while the elevator is operated over full range between stops (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

(12) When a uniform operating effort is achieved, secure end-cap to housing in the following manner. Drill four 0.1935 in.dia. holes in the end-cap, from existing holes in housing. Coat locating bolts with jointing compound; fit locating bolts and secure with stiffnuts.

(13) Functionally test elevator trim control system (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

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# ELEVATOR SERVO MOUNTING - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove servo mounting

(1) Remove elevator servo from servo mounting (see Chapter 34, FLIGHT CONTROL SYSTEM).

(2) Disconnect turnbuckles of cables between servo mounting and autopilot drum of circular and elliptical pulley drum.

(3) Remove four bolts securing servo mounting to mounting plate. Remove servo mounting complete with cables.

(4) Remove screws securing cable guard to servo mounting, and remove guard posts. Remove screws and lockwashers from each end of cable groove, and remove cables from capstan (cable drum). Retain cable guard.

### B. Install servo mounting

NOTE : Operations (1) and (2) are only applicable if a new servo mounting is being fitted. Operations (3) and subsequent apply if the existing servo mounting is being fitted.

Special tools and equipment :-

| | | | |
|---|---|---|---|
| Rigging pin set | .. | .. | HSA 25-7Y15A |
| Tensiometer | .. | .. | T5/2002/401/00 (Teleflex) |

(1) Remove and discard ring, mounted on guard posts, over end of cable drum. Remove guard posts.

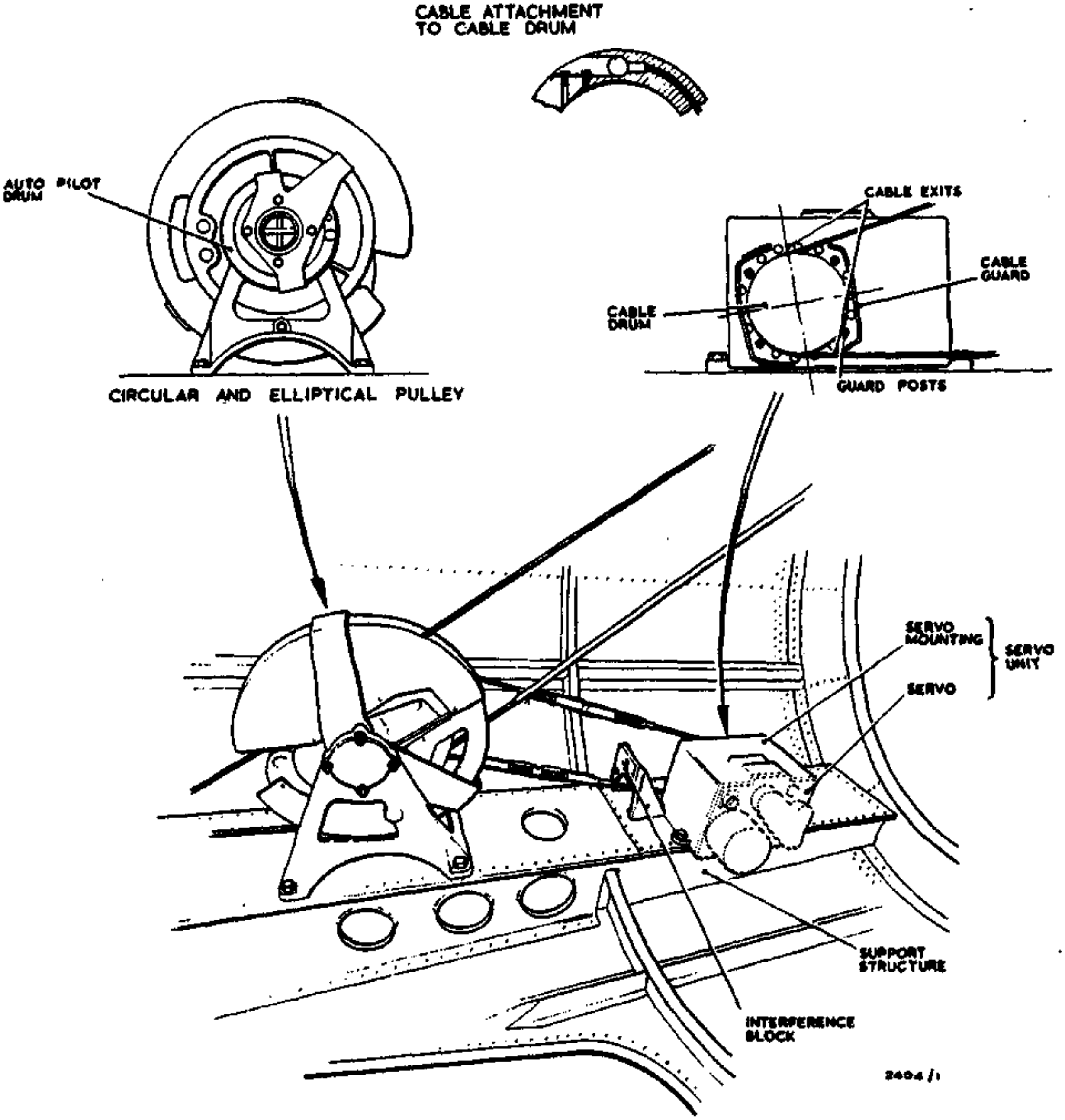
(2) Remove screws and lockwashers from each end of cable groove.

(3) Fit cable ends into servo mounting cable drum, and fit screws and lockwashers at each end of cable groove. Tighten screws and wire-lock heads together. Wrap cables onto cable drum to fill each groove, between the cable attachment points.

NOTE : Turnbuckles of elevator servo cables are of different sizes to prevent cross-connection. Ascertain cable arrangement on capstan by reference to ends of cables already on autopilot drum of circular and elliptical pulley drum.

(4) Secure four guard posts to servo mount, at positions shown on Fig.201 and wire-lock. Locate cable guard around capstan, and secure to guard posts with screws. Wire-lock screws in pairs.

(5) Locate servo mounting on mounting plate and secure with four bolts. Wire-lock bolt heads together in pairs.



Servo mounting installation
Fig.201

...Elevator servo mounting - Maintenance practices continued

(6) Operate elevator to neutral, and insert rigging pin through rigging hole of circular and elliptical pulley drum and its mounting.

(7) Connect cables between servo mounting and autopilot drum (Fig.201), pulling sufficient cable off servo mounting cable drum to suit connection. Set tensiometer to suit 10 cwt cables, and tension cables to 95 lb/100 lb. Check that turnbuckles are in safety, tighten locknuts and wire-lock.

(8) Remove rigging pin from circular and elliptical pulley drum.

(9) Operate control column through full range allowed by elevator primary stops. Check servo mount cable drum and associated cables for full and free movement.

(10) Install elevator servo in servo mounting (see Chapter 34, SERVOMOTOR AND MOUNTING).

(11) Functionally test elevator control system, refer to Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS.

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## ELEVATOR TRIM TAB SERVO MOUNTING - MAINTENANCE PRACTICES

NOTE : Adjustment of the tension of the endless loop of chain between sprocket of trim tab servo and the sprocket on male drive shaft entails removing the trim tab servo and adjusting the shims between trim tab servo and mounting.

### 1. Removal/Installation

### A. Remove sprocket assembly of trim tab servo unit

(1) Remove drive assembly from sprocket assembly (Chapter 34, TRIM TAB SERVO UNIT).

(2) Operate control column to raise G weight arm, and temporarily secure G weight arm, (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEM).

(3) Remove bolts securing housing to servo mounting. Restrain sprocket from lateral movement, and withdraw assembly of housing and male drive shaft from servo mounting.

NOTE : Sprocket will slide off serrations of male drive shaft, and remain with endless loop of chain.

(4) Remove nuts securing sprocket assembly of trim tab servo to mounting, and lift off sprocket assembly; note thickness and position of shims on studs, and remove shims.

(5) Remove screws securing chain guard to sprocket assembly, and remove guard posts. Remove chain from sprocket assembly. Retain chain guard.

### B. Install sprocket assembly of trim tab servo unit

Materials required :-

| | |
|---|---|
| Grease .. .. .. | DTD 844, 866 or 5598 |

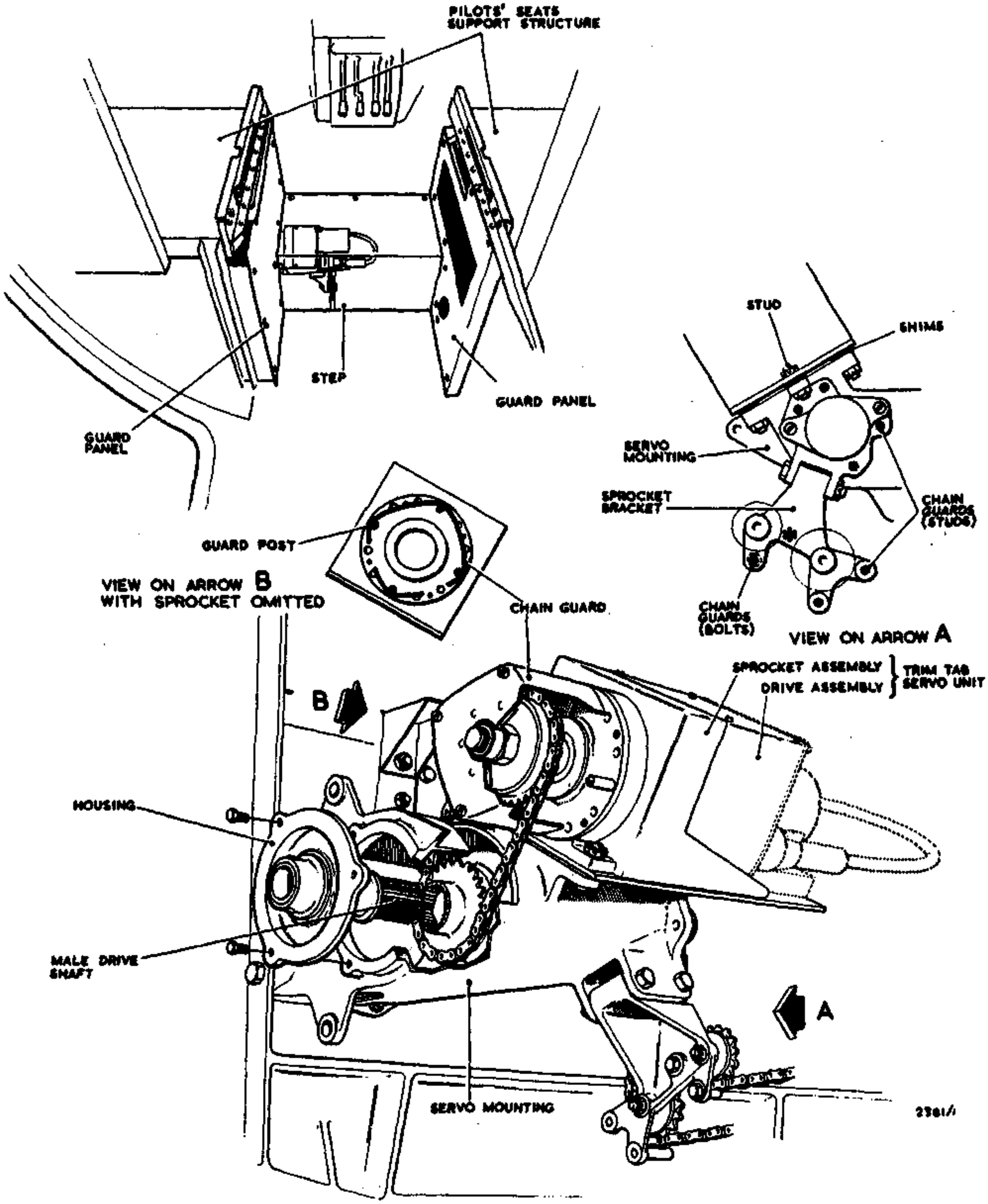
NOTE : Operation (1) is only applicable when a new sprocket assembly is being fitted. Operations (2) and subsequent apply if the existing sprocket assembly is being refitted.

(1) Remove and discard plate, mounted on guard posts, over end of sprocket assembly. Remove guard posts.

(2) Lightly lubricate chain with grease and fit chain to sprocket assembly.

(3) Secure four guard posts to sprocket assembly at positions shown on Fig.201. Locate chain guard around sprocket, and secure chain guard to guard posts with four screws and lockwashers. Wire-lock screws in pairs.

(4) Position sprocket in chain, feed chain into servo mounting, and locate sprocket assembly on studs in servo mounting.



Trim tab servo mounting
Fig.201

...Elevator trim tab servo mounting - Maintenance practices continued

(5) Smear male drive shaft serrations with grease.

(6) Fit assembly of housing and male drive shaft into servo mounting, locating male drive shaft in sprocket and female drive shaft. Estimate shimming required to tension chain adequately.

(7) Remove assembly of housing and male drive shaft and sprocket assembly from servo mounting. Fit shims to studs, refit sprocket assembly and assembly of housing and male drive shaft to servo mounting. Check chain for adequate tension, and adjust shims as necessary.

(8) When operation (7) is satisfactorily completed, secure sprocket assembly to servo mounting with nuts, and lock nuts with split pins.

(9) Remove means of temporarily securing G weight arm.

(10) Install drive assembly in sprocket assembly (see Chapter 34, TRIM TAB SERVO UNIT).

(11) Functionally test elevator trim control system (see Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROL SYSTEMS).

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# FLAP CONTROL SYSTEM - DESCRIPTION AND OPERATION

## 1. General

Fig. 1 depicts diagrammatically the layout of the flaps control system.

## 2. Description

Flaps control is by a selector lever mounted on the control pedestal in the flight compartment. In the pedestal the selector lever is coupled by a spring strut to an operating drum. Cables from this drum are routed rearward through the fuselage to terminate on a spring drum assembly. A connecting rod from a lever arm on the base of the drum assembly is attached to the flap control unit input lever.

The flap control unit comprises a hydraulic motor and gearbox mounted on a common valve block. The hydraulic motor is a swashplate type unit having five cylinders. Internal gearing drives the output shafts which project from the left and right-hand sides of the unit. The output shafts interconnect via torque shafts, bevel gearing and universal joints, to the respective flap screwjack mounted in each wing. Friction devices are incorporated in the jacks to prevent the flaps moving from selected positions.

Hydraulic fluid from the main system is normally fed to the flap control unit through an inlet port. In the event of main system failure, the auxiliary hydraulic system can supply fluid to the unit through an emergency port. A cut-off valve in the control unit is linked externally, via a lever and connecting rod, to a position receiver and only operates to intercept the flow, and stop the unit, in response to a flap asymmetry signal from the receiver. Within the control unit a springbox attached to a relay valve ensures that the valve closes automatically should failure occur in the input linkage system.

A synchronizing cable circuit is provided to prevent asymmetry between flaps. It consists of a central receiver unit and two transmitters located at the remote ends of the drive shafts and driven by links attached to inner flap hinge arms.

A Desynn flap position transmitter, fitted forward of the left synchronizer transmitter, is connected electrically to a flap position indicator in the centre instrument panel.

### A. Selector lever and baulk unit

The flap selector lever moves in a gate on the control pedestal; the gate allows four flap selections - UP, TO (take-off), APP (approach) and LND (land). A baulk unit, located in the control pedestal ensures selection of the TO position when the selector lever is moved from the UP position or towards UP from APP or LND.

The baulk unit embodies a baulk lever which projects into the flap lever gate; baulk lever rotation is limited by a slot, and two compression springs maintain it in the centre of the slot. The baulk lever is also spring loaded towards the slotted side of the flap gate.

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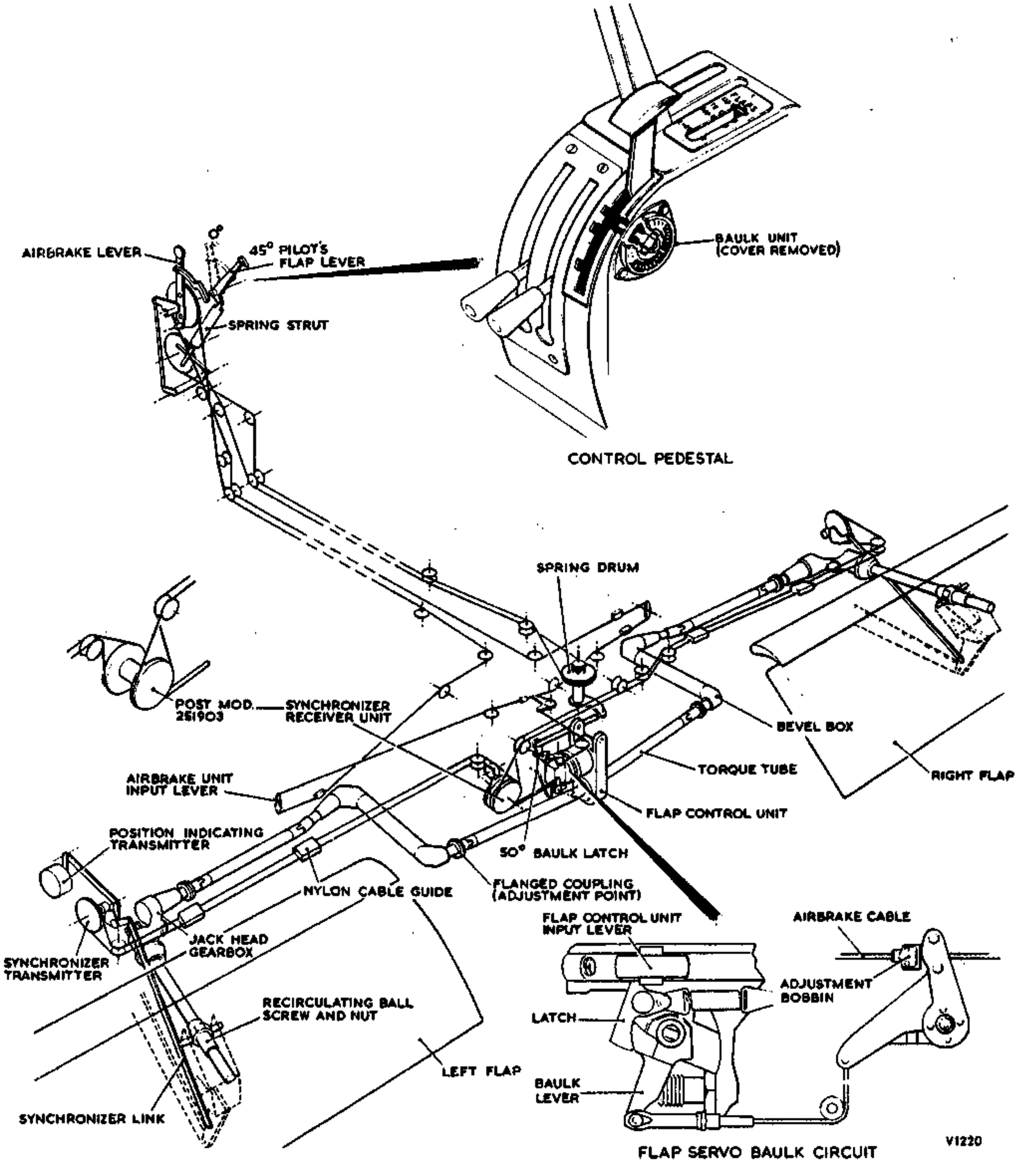

Flap control system
Fig.1

### B. Flap control unit baulk mechanism (Fig.1)

The mechanism consists of a baulk and a baulk lever attached to the flap control unit. The baulk is maintained in its operative position by a tension spring. The baulk lever is connected to the airbrake balance cable (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM) via a cable and bell-crank lever. The baulk mechanism prevents flap movements beyond the land position.

## 3. Operation

### A. General

Movement of the flap selector lever is transmitted to the flap control unit input lever via the cable circuit; the spring strut and spring drum compensate for any lag in the rate of movement between selector lever and input lever. The input lever moves a relay valve which allows fluid to the hydraulic motor. Rotation of the motor shaft is transmitted through a worm gear to the flap drive shafts. A resetting screw shaft causes the relay valve to be closed when the motor has turned through the revolutions required to achieve the selected flap setting. Drive shaft rotation turns the screwjacks via a reduction gear box. Rotation of the screwjacks causes the nut assemblies to move relative to the screws thus pivoting the flaps about the hinges by an amount proportional to the selector lever movement.

Under normal operating conditions, the spools on the receiver unit are rotated equal amounts in opposite directions; the pinion, therefore, rotates freely on the output plunger. Should one drive shaft cease to operate then one bevel wheel only is rotated thus rolling the pinion around the stationary bevel wheel. This movement displaces the output plunger and, via the connecting rod, moves the flap unit cut-off valve to stop power supply to the flap motor.

### B. Selector lever and baulk unit

When the flap selector lever is moved from the UP position, the baulk lever is contacted and rotates until it arrests the selector lever opposite the TO slot in the gate. After the selector lever has entered the TO slot, the baulk lever returns to its original position and the selector lever can be moved to the APP and LND positions. The baulk unit operates in a similar fashion when the selector lever is moved towards UP from APP and LND.

### C. Flap control unit baulk mechanism

The flap control unit baulk mechanism forms a positive stop; the movement of the flap unit input lever is arrested to prevent the flaps moving from the land position until lift dump is selected on the airbrake lever. When lift dump is selected, an adjustable bobbin on the airbrake balance cable transmits movement to a bell-crank lever which is cable-connected to the baulk lever; the lever is rotated out of the way of the baulk and permits

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movement of the input lever beyond the land position. The baulk acts only on down selection allowing free return of the input lever.

D. Lift dump facility

The flaps can be lowered beyond the land position to provide a lift dump facility (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM). When the flaps are at land position then the lift dump facility may be selected by an upward and backward movement of the airbrake lever. The spring drum compensates for any lag in the rate of movement between airbrake selector lever and flap control unit input lever.

* * *

# FLAP CONTROL SYSTEM – ADJUSTMENT/TEST

**WARNING: IF A PART OF THIS SYSTEM IS DISMANTLED, ADJUSTED, REPAIRED OR REPLACED, A FULL INVESTIGATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT DISTORTION, TOOLS, RAGS, OTHER OBJECTS OR UNWANTED MATERIAL THAT COULD PREVENT THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM ARE NOT PRESENT, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE WORK AREA ARE CLEAN.**

**WARNING: IF A PART OF EITHER THE MAIN OR ANY ASSOCIATED SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, THAT PART OF THE SYSTEM WHICH HAS BEEN CHANGED SHALL BE SUBJECTED TO A DUPLICATE INSPECTION FOR CORRECTLY INSTALLED LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THE WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

**WARNING: WHEN WORKING ON THE FLIGHT CONTROL SYSTEMS, DISPLAY WARNING NOTICES IN THE FLIGHT COMPARTMENT TO PREVENT OPERATION OF THE CONTROLS.**

**WARNING: MAKE SURE THAT THE FLYING CONTROL SURFACE RANGE OF TRAVEL IS CLEAR OF ANY OBSTRUCTIONS**

*NOTE: For routine lubrication data refer to the Maintenance Schedule.*

| Equipment/Material | Part/Item No. |
|---|---|
| Tensiometer | Teleflex T5 2002/401/00 |
| Inclinometer and feeler gauges | Local supply |

## 1. Rig flap system

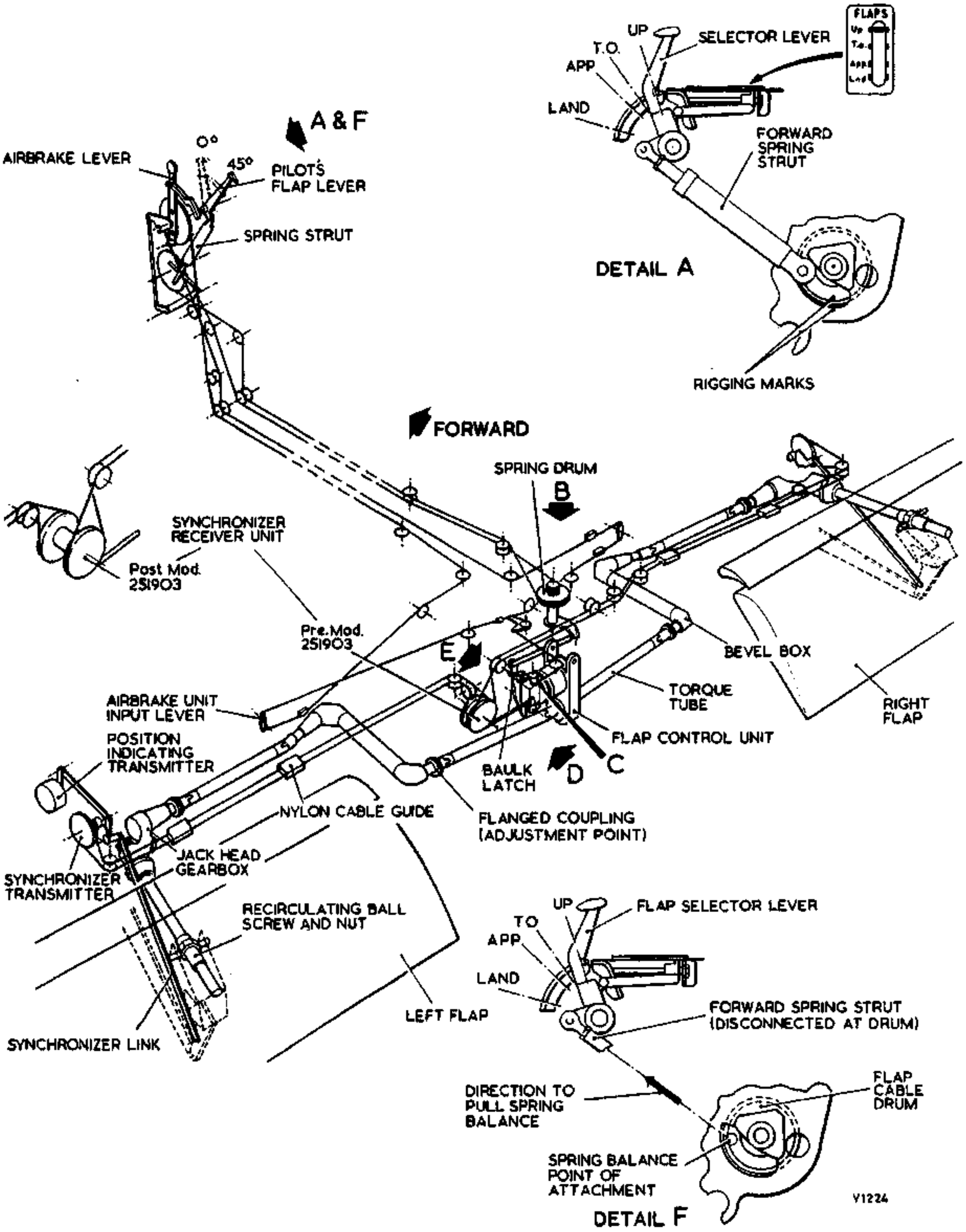
### A. Rig flap control system from control pedestal to spring drum *(Figure 501)*

(1) Disconnect connecting rod between spring drum and flap control unit. Access is through aft wall of port wheel well.

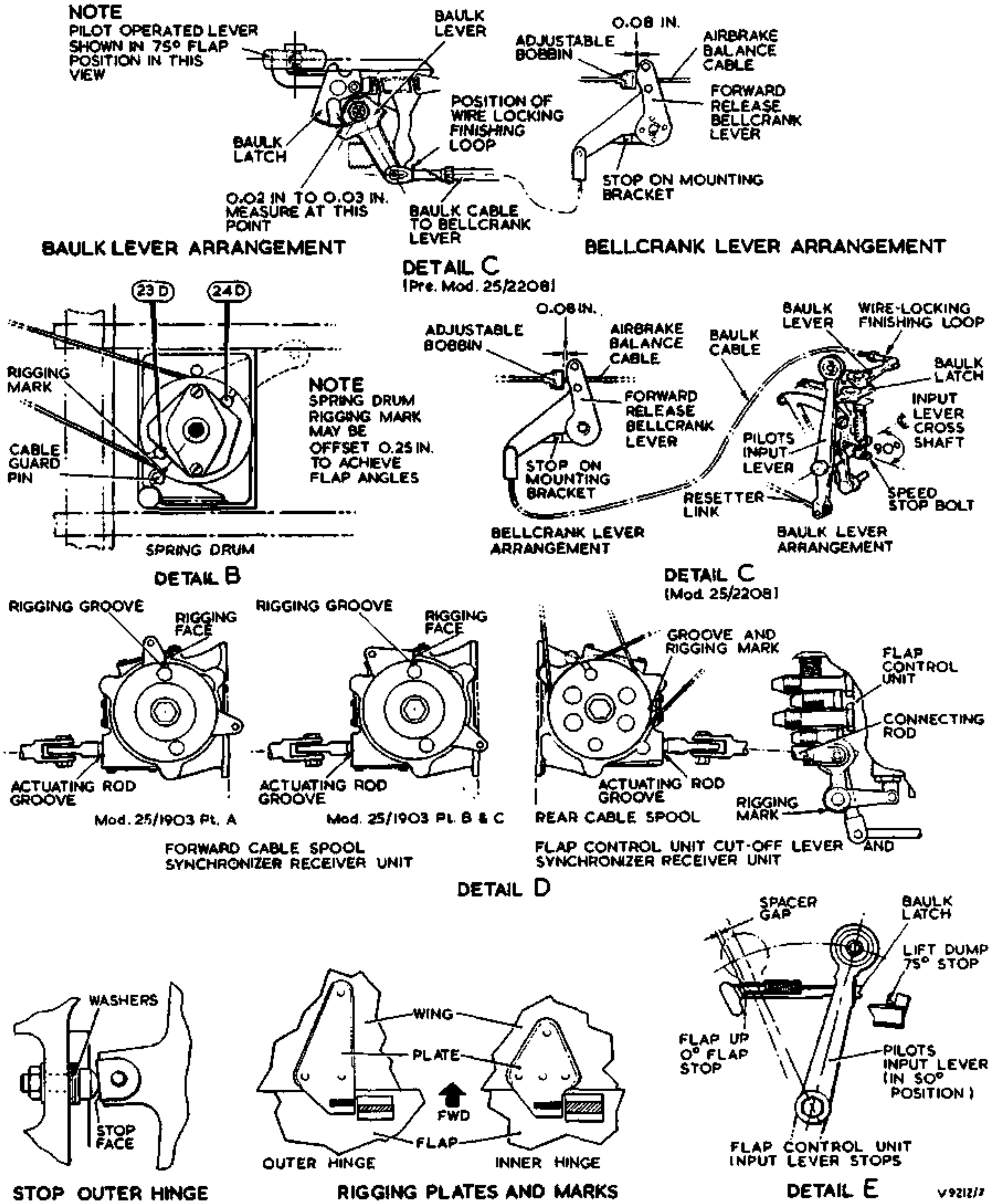
(2) Position flap selector lever in the FLAPS UP gate.

(3) Align rigging mark on flap cable drum in control pedestal with mark on right hand side panel of control pedestal. Check that the forward spring strut can be operated freely. If necessary, adjust eye end of spring strut to align rigging marks; make sure that no load is imposed on the spring strut while checking alignment. Check that the eye end is in safety, tighten locknut and wire-lock.

(4) Operate pilots' lever over full range a number of times checking that the flap lever baulk is engaged when TAKE OFF position is approached from either direction and can only be disengaged by entering flap lever in TAKE OFF gate.



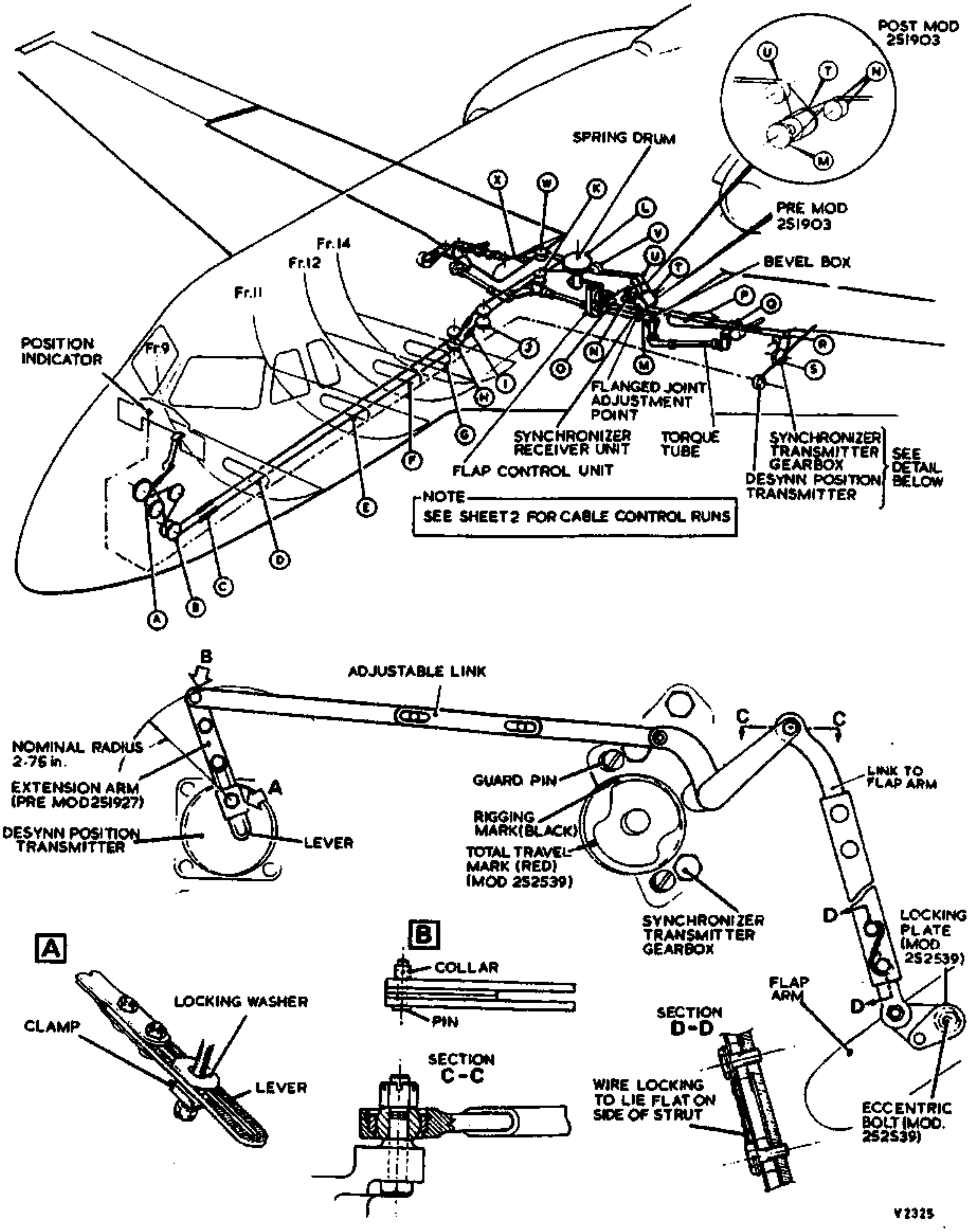
Flap control system rigging
*Figure 501*
*(Sheet 1 of 2)*



Flap control system rigging

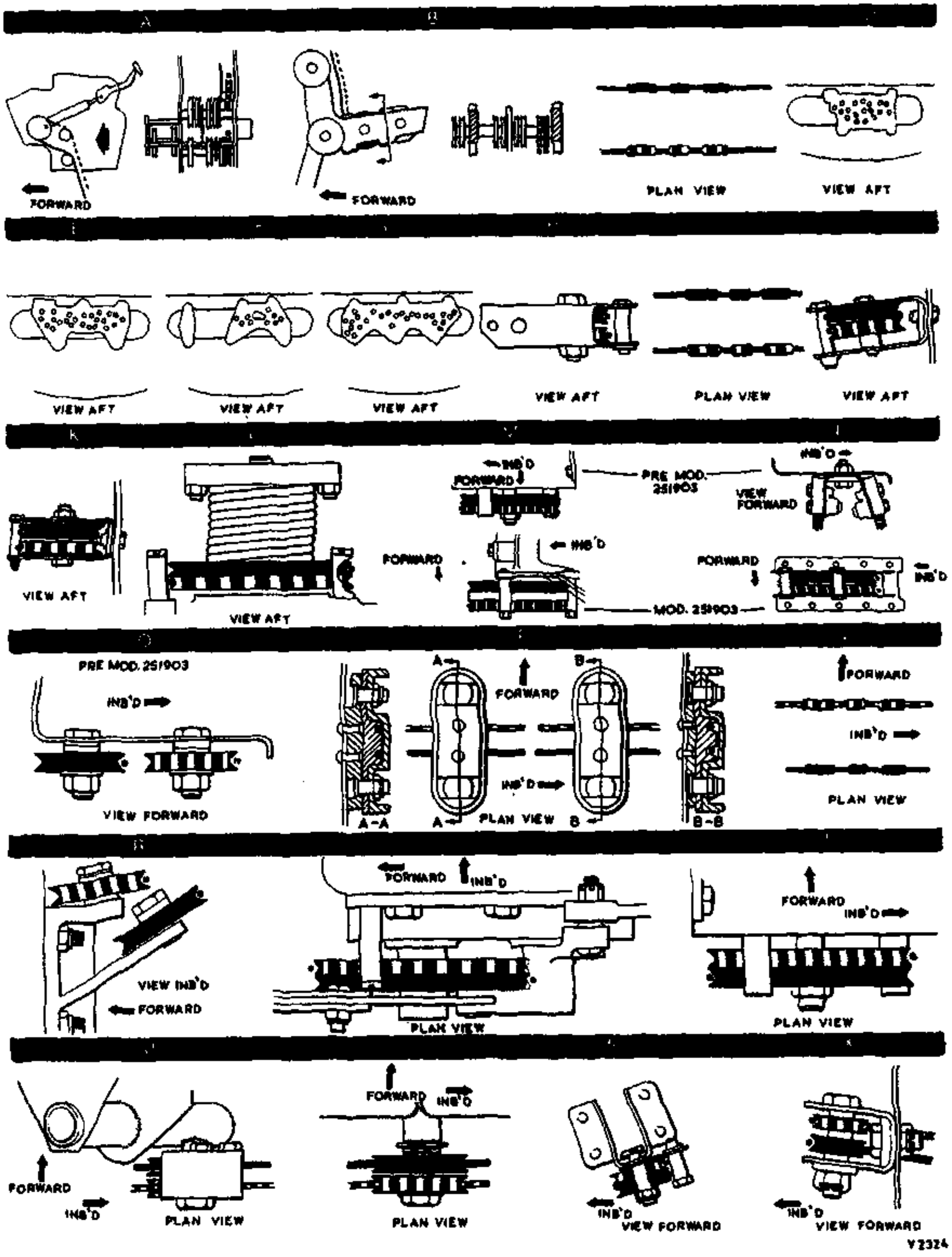
*Figure 501*

*(Sheet 2 of 2)*


POST MOD 251903
U
T
N
M
SPRING DRUM
X
W
K
L
V
U
T
PRE MOD 251903
BEVEL BOX
Fr.14
Fr.12
Fr.11
Fr.9
POSITION INDICATOR
P
Q
R
S
J
I
H
O
N
M
G
F
E
D
C
B
A
FLANGED JOINT ADJUSTMENT POINT
SYNCHRONIZER RECEIVER UNIT
TORQUE TUBE
SYNCHRONIZER TRANSMITTER GEARBOX
DESYNN POSITION TRANSMITTER
SEE DETAIL BELOW
FLAP CONTROL UNIT
B
ADJUSTABLE LINK
NOMINAL RADIUS 2·75 in.
EXTENSION ARM (PRE MOD251927)
A
DESYNN POSITION TRANSMITTER
LEVER
GUARD PIN
RIGGING MARK(BLACK)
TOTAL TRAVEL MARK (RED) (MOD 252539)
SYNCHRONIZER TRANSMITTER GEARBOX
C
C
LINK TO FLAP ARM
D
D
LOCKING PLATE (MOD 252539)
FLAP ARM
ECCENTRIC BOLT (MOD. 252539)
A
LOCKING WASHER
CLAMP
LEVER
B
COLLAR
PIN
SECTION C-C
SECTION D-D
WIRE LOCKING TO LIE FLAT ON SIDE OF STRUT
V2325

NOTE
SEE SHEET 2 FOR CABLE CONTROL RUNS

Flap control system rigging
*Figure 502*
*(Sheet 1 of 2)*



Flap control system rigging

*Figure 502*

*(Sheet 2 of 2)*

(5) Move pilots' flap lever to LAND and airbrake lever to OPEN; make sure that when the airbrake lever is raised and moved radially to initiate lift dump selection, the roller on the airbrake lever engages in the slot on the flap cam lever without undue 'lifting' force being applied (AIRBRAKE AND LIFT DUMP CONTROL SYSTEM). Select flap lever to UP and airbrake lever to closed.

(6) Align rigging mark on spring drum with centerline of guard pin as shown. Access is from inside fuselage. Set tensiometer for 10 cwt cables and position on flap cables between frames 9A and 10. Adjust turnbuckles connecting cable ends 23B - 23B, 23C - 23C, 24B - 24B, 24C - 24C to achieve cable tension of 35 lb. to 40 lb. Check turnbuckles for safety, tighten locknuts and wire-lock.

NOTE: *24B - 24B, 24C -24C must be tensioned first as these cables act against the internal stop of the spring drum.*

(7) Disconnect forward spring strut from flap cable drum. Set (by hand) the cable drum to 'lift dump' position. Attach a spring balance to cable drum *(Detail F)* and check that effort required to initiate movement of cable system is not more than 7 lb. This figure must not be exceeded between 'LIFT DUMP' and 'FLAPS UP' position. Remove spring balance and secure spring strut to flap cable drum.

(8) Make sure the output lever on the spring drum can be operated freely and make sure that the load required to move the output lever shaft away from the spring drum internal stops is 19 lb to 25 lb in. (5.35 to 7 lb at lever attachment point to connecting rod).

(9) Operate the flap circuit fully a number of times. Operation of the circuit should be smooth and without highspots. Return the flap selector lever to UP position and check that all previous rigging requirements are satisfied.

**B. Rig outboard of flap control unit** *(Figure 501 and Figure 502)*

NOTE: *During rigging of flaps and at any other time when the flap control unit is operated manually, the load applied to the end of the input lever must not exceed 10 lb. Hydraulic power during such movement may be supplied from a suitable rig or the airplane ground services handpump. Note that use of the handpump will materially reduce the rate at which the flap unit input lever may be moved.*

(1) Make the synchronizer unit inoperative by disconnecting and removing the connecting rod between synchronizer unit actuating rod and flap control unit cut-off valve lever and maintain cut-off valve lever in rigged position. Disconnect the link between the flap arm and synchronizer transmitter gearbox *(Sheet 1).*

NOTE: *Mod.252155: remove cable guard and transmitter shield to gain access.*

**CAUTION: THE POSITION TRANSMITTER MAY BE DAMAGED DURING RIGGING IF THE ADJUSTABLE LINK IS OUT OF ADJUSTMENT.**

(2) If the Desynn position transmitter at the left inner hinge or its linkage have been disturbed, disconnect the adjustable link from the operating lever on the synchronizer transmitter gearbox before starting to rig the system.

(3) Remove right inner torque tube (FLAP DRIVE SHAFTS).

(4) Manually operate the flap control unit input (use ground services handpump to supply hydraulic pressure) and raise left flap until the forward edge of the rigging line on flap and the aft edge of the rigging line on plate at outer hinge are in alignment *(Sheet 2).*

*NOTE: Before correct alignment can be attained, it may be necessary to break the flanged joint of the inner torque tube, run the flap unit back to the land position and then reconnect at the flanged joint to achieve alignment (FLAP DRIVE SHAFTS)*

(5) When the requirements of paragraph (4) have been met, adjust the outer hinge stop to just contact the stop face as illustrated.

(6) Disconnect left inner torque tube at flanged coupling (FLAP DRIVE SHAFTS).

(7) Place a 0.10 in. spacer as shown *(Detail E),* between the flap unit input lever and UP stop (use ground services handpump to supply hydraulic pressure). Check that conditions of paragraph (5) above are still the same.

**CAUTION: IF BOLT HOLES DO NOT LINE UP, THE FLAP UNIT INPUT LEVER MAY BE MOVED FURTHER AWAY FROM THE UP STOP BY 0.02 in. IN ORDER TO ACHIEVE ALIGNMENT. ON NO ACCOUNT MAY THIS MAXIMUM GAP BE EXCEEDED.**

(8) Reconnect left inner torque tube at flanged coupling (FLAP DRIVE SHAFTS).

**CAUTION: THE 0° AND 75° STOPS FOR THE INPUT LEVER OF THE FLAP UNIT ARE SET DURING UNIT MANUFACTURE AND MUST NOT BE CHANGED DURING RIGGING OF THE AIRPLANE. FOR ADJUSTMENT OF THE 75° STOP, REFER TO FLAP SCREWJACK AND REDUCTION GEARBOX.**

(9) Remove spacer and, using ground services handpump, slowly move flap unit input lever towards UP stop. During movement of lever before it reaches UP stop, observe the rigging lines on flap and wing-mounted rigging plate at inner hinge, and make sure that even when the input lever is against the UP stop, the aft edge of the flap line does not move forward of the forward edge of the wing line.

(10) Make sure the outer hinge rigging line on the flap has now moved in line with the line on the wing mounted plate. This movement is caused by some of the flap wind-up being seen as relative movement between flap and wing at outer hinge, despite the outboard hinge stop.

(11) On completion of rigging of left flap, reconnect right inner torque tube (FLAP DRIVE SHAFTS) and rig right flap as for left flap.

*NOTE: Do not disconnect left flap torque tubes.*

(12) Finally install connecting rod between input lever and spring drum lever with flap selector lever at UP position and flap unit input lever against UP stop. Examine for safety, tighten locknuts and wire-lock. Make sure that flap range of movement is correct (Paragraph 3.B.), if necessary the spring drum (paragraph 1.A.(6)) may be off-set 0.25 in. either way from the rigged position, to achieve flap angles; make sure that all other rigging requirements are met.

**C. Rig Lift dump mechanism** *(Figure 501)*

(1) Make sure that airbrake control system is rigged in accordance with AIRBRAKE AND LIFT DUMP CONTROL SYSTEM.

(2) Pressurize hydraulic system (Chapter 29, MAIN SYSTEM).

(3) Select the flap lever to LAND (45° flap angle) and the airbrakes to OPEN.

(4) At the baulk release cable, make sure that with forward baulk release bellcrank on its stop, a clearance of 0.08 in. exists between face of bellcrank and the adjustable bobbin *(Detail C)*. If necessary, adjust bobbin to achieve dimension.

(5) Disconnect baulk cable from the bellcrank lever by disconnecting the tension rod. Select LIFT DUMP, moving the airbrake lever slowly toward the LIFT DUMP position until the flap control unit input lever contacts the baulk latch; the flap angle under this condition must not exceed 53°.

(6) Select airbrake lever to SHUT and flap lever to UP. Reconnect baulk cable to bellcrank lever at tension rod.

(7) Pre-mod.252208:
Select lift DUMP and make sure the baulk latch is free of input lever. Adjust baulk cable tension until a 0.020 in. to 0.030 in. gap exists between adjacent faces of the latch and baulk lever (Detail C). Select the airbrake lever to SHUT and flaps UP.

Mod.252208:
With airbrakes OPEN and flaps at LAND, tension baulk cable until speed stop bolt is 90° to input lever cross shaft (Detail C) while maintaining the 0.08 in. clearance set in paragraph (4).

**CAUTION: THE POSITION OF THE SPEED STOP BOLT IS CRITICAL, THEREFORE ADJUST WITH CARE.**

(8) Select flaps 45°, then select airbrake lever to LIFT DUMP and check that baulk latch is released and does not stop the input lever as it moves towards the 75° stop. Select airbrake lever SHUT followed by flap lever to 25° to reset the baulk lever and latch.

(9) Repeat paragraph (8) five times and make sure that baulk lever and latch go back automatically, to their initial positions and that the requirements of paragraph (7) are met each time. Finally, peen lock bolts securing adjustable bobbin if disturbed.

(10) Select flaps to UP and depressurize hydraulic system.

**D. Rig flap synchronizer mechanism** *(Figure 501 and Figure 502)*

(1) With flaps 'up', align groove in each sychronizer receiver cable spool with marks on body, or, for Mod.251903 on the forward spool align groove with rigging face, and position actuating rod groove (Detail D). Align rigging mark on each transmitter gearbox spool with guard pin (Sheet 1).

(2) Lower flaps. Set tensiometer for 5 cwt cables and position on synchronizer circuit cables adjacent to the transmitter. Make sure that the cable tensions are set to 35-40 lbs. Adjust turnbuckles if necessary maintaining the conditions of paragraph (1). Make sure turnbuckles are in safety, tighten locknuts and wire-lock. Raise the flaps.

(3) Install connecting rod to synchronizer unit actuating rod and flap control unit cut-off valve lever. Adjust rod as necessary (whilst maintaining conditions of paragraph (1) and (2)) to align rigging marks on cut-off lever and flap control unit; examine rod for safety and tighten locknut.

(4) If the link between the flap arm and synchronizer transmitter gearbox has been moved, then make sure the flap control system has been correctly rigged from the pedestal to the spring drum and from outboard of flap control unit. With flap selector lever at UP and flap control surface 'up', adjust drive links between flap arm and synchronizer gearbox whilst maintaining requirements of paragraph (3). Make sure that face serrations are fully engaged before tightening and wire-locking the bolt heads.

(5) Pressurize hydraulic system (Chapter 29, MAIN SYSTEM).

(6) Mod.252539: Select flaps to LAND, move airbrake lever to LIFT DUMP position, and make sure that the transmitter gearbox spool has rotated 270°, i.e. with red 'total travel' mark on spool in line with guard pin; if necessary adjust as follows:

  (a) Remove locking plate from link attachment on flap arm, and rotate eccentric bolt in 9° increments clockwise to decrease, or counter clockwise to increase movement of left spool (opposite rotation for right spool).

  *NOTE: Locking plate is reversible to obtain 9° increments.*

  (b) If red 'total travel' mark cannot be aligned using all of the adjustment, then the opposite flap transmitter gearbox spool can be adjusted to produce equal rotation of pulleys. The red 'total travel' mark must not be more than 0.20 in. out of alignment.

  (c) Install locking plate to eccentric bolt and secure with stiffnut.

  (d) Select airbrake lever to SHUT.

(7) Raise and lower flaps several times whilst observing the synchronizer receiver to make sure that the cable circuits operate smoothly without snatching. Observe that there is not more than ±0.035 in. movement of the synchronizer receiver actuating rod. If movement is in excess of this, do the following:

  (a) Examine the flap drive system, gear boxes, shafting, flap jacks and attachments and the synchronizer mechanism for excessive wear. Renew components if necessary.

  (b) Do a check of the synchronizer cable tensions.

  *NOTE: If there is excessive cable wear on one side of the airplane only, this may result in the movement of the synchronizer receiver actuating rod in excess of 0.035 in. which could cause the system to be shut down. It is therefore important to make sure that the backlash is approximately equal between left and right cables.*

(c) Mod.252539: Recheck paragraph (6); Pre Mod.252539: proceed as follows.

(d) Lower the flaps to the down position.

(e) Remove connecting rod between synchronizer receiver and the flap control unit.

(f) Slacken the bolts in the link to each flap arm *(Detail DD)*

(g) Reposition the synchronizer receiver actuating rod to align the rigging groove (paragraph (1)) by moving the rod to 'backdrive' the system.

(h) Make sure that the rigging marks on the transmitter and receiver units are aligned.

(i) Retighten the bolts on the link to each flap arm.

(j) Reconnect the connecting rod between the synchronizer receiver and the flap control unit.

(k) Function the flaps several times.

(l) If still outside of the dimensions specified in paragraph (7), repeat paragraphs (7) (a) to (7) (j) until actuating rod movement is within the specified figure.

(m) Tighten and lock the bolts in the link to flap arm and lock the connecting rod between the synchronizer receiver and control unit.

(8) Select flaps APP (Approach - 25°).

(9) Position inclinometer on the left flap; take and record inclinometer indication.

(10) Disconnect the right-hand flap inner torque tube at the flanged coupling.

(11) Select flaps LAND (45° flap angle). The left flap will then move down until stopped by operation of a relay valve in the flap control unit.

(12) Take again an inclinometer indication of the left flap angle. The increase in angle between this indication and that obtained in paragraph (9) must be between 3° and 5°.

(13) If paragraph (12) requirement not met, continue as follows:

(a) Release hydraulic system pressure (Chapter 29, MAIN SYSTEM), until accumulator shows 1000 psi.

(b) Release flap selector lever from the LND gate and allow the lever to find its own position, this will not necessarily be gated.

(c) Use the inclinometer on the right-hand flap, manually turn right-hand flap outer torque tube to lower flap to an angle equal to that obtained in paragraph (12).

(d) Reconnect right-hand inner torque tube at flanged coupling.

(e) If angle obtained in paragraph (12) is greater than 5°, disconnect the connecting rod between the synchronizer actuating rod and the flap control unit cut-off valve lever and shorten the rod; if the angle is less than 3° lengthen the rod.

(f) Pressurize hydraulic system (Chapter 29, MAIN SYSTEM). Select flaps APP (Approach - 25°) and repeat paragraphs (9) to (12) inclusive. If necessary repeat the complete paragraph (13) until the requirements of paragraph (12) are met.

NOTE: *Upon completion of this paragraph, the rigged position of the cut-off valve may be slightly out of alignment. Providing the requirements of paragraph (12) are satisfied, this is acceptable.*

(14) Repeat paragraphs (6) to (13) inclusive for the right-hand flap.

(15) Tighten flap torque tube flanged couplings. Make sure that the cable tension rods are in safety, tighten locknuts and wire-lock. Install and secure slotted nuts to bolts which hold the connecting rod to synchronizer actuating rod and flap control unit; lock the nuts with cotter pins.

**E. Adjust flap position transmitter linkage** *(Figure 502)*

(1) Disconnect the adjustable link from the position transmitter extension arm by removing the cotter pin, collar and shear pin.

**CAUTION: DO NOT ALLOW THE TRANSMITTER TO FLICK BACK ON TO ITS STOP.**

(2) Pressurize hydraulic system (Chapter 29, MAIN SYSTEM).

(3) Energize d.c. busbars (Chapter 24, GENERAL).

(4) Select the flaps to UP, LAND and LIFT DUMP positions. At each position, manually operate the Desynn transmitter arm to align the hole in end of arm with hole in end of adjustable link, checking that the flap position indicator on the center instrument panel shows the appropriate setting. If necessary, adjust the position transmitter linkage by trial and error to achieve correct readings.
Adjustment can be done by alternately adjusting the effective length of the extension arm/lever on the Desynn transmitter (to alter indicator pointer range of movement) and the adjustable link from the synchronizer gearbox (to alter pointer position). During adjustment, make sure there is a small clearance between the integral stops of the transmitter and its lever when the flaps are selected to the UP or LIFT DUMP positions.

NOTE: *Increasing the effective length of the extension arm/lever on the position transmitter decreases the indicator pointer movement.*

(5) After adjustment, secure the position transmitter lever with bolt and stiffnut, and secure the slotted sections of adjustable link together with bolts, washers and stiffnuts. Secure adjustable link to position the transmitter extension arm with shear pin and collar, then lock with cotter pin. Mod.252155: Refit cable guards and transmitter shields.

(6) Raise and lower the flaps by gated increments checking that corresponding readings are obtained on the pilots' instrument.

(7) Depressurize hydraulic system.

(8) De-energize d.c. busbars (Chapter 24, GENERAL).

## 2. Do a functional test of flap control system

### A. Procedure

(1) Pressurize the hydraulic system (Chapter 29, MAIN SYSTEM).

(2) Energize d.c. busbars (Chapter 24, GENERAL).

(3) Do a check of the flap operating times (Chapter 29, MAIN SYSTEM).

(4) Select flap lever from UP to TO, APP and LND positions; check that the flap position indicator on the center instrument panel shows the appropriate indication at each position. Check that the flap selector lever baulk unit makes selection of TO position as the flap lever is selected from UP to LND and towards UP from LND or APP.

(5) Gain access to flap control unit through port wheel well wall.

(6) Select airbrake lever to SHUT and flap lever to LND.

(7) Manually operate flap unit input lever until it is arrested, by the baulk. Flap angle under this condition must not exceed 53°.

(8) Select airbrake to open, repeat paragraph (7).

(9) Lift airbrake lever and select LIFT DUMP position. Make sure that the baulk lever is turned clear of the baulk and does not prevent movement as the flap unit input lever moves past the baulk toward the lift dump stop. Select airbrake lever to OPEN position and check that the input lever returns to its initial position automatically in its action.

(10) Depressurize hydraulic system.

(11) Check that flap position indicator pointer moves to a position between UP and DUMP when the d.c. busbars are de-energized.

## 3. Rigging, Range of Movement and Friction checks

### A. Examine rigging of flap system *(Figure 501 and Figure 502)*

(1) Pressurize hydraulic system (Chapter 29, MAIN SYSTEM).

(2) Energize d.c. busbars (Chapter 24, GENERAL).

(3) Select flap lever to UP position. Do a check to make sure that the following are shown at the same time:

(a) The rigging marks on the pulley drum and control pedestal are aligned when the spring strut is in a no load condition.

(b) The rigging mark on the spring drum is within 0.25 in. of the centerline of guard pin. Note that access is from inside fuselage.

(c) Cable tension is 35-40 lb. (Set tensiometer for 10 cwt cables and position it on flap cables between frames 9A and 10).

(d) Rigging lines on flaps and wing mounted plates are in alignment at outboard hinges and that at inboard hinges, the aft edge of flap line does not lie forward of forward edge of wing line.

(4) Select flap lever to TO position.

(5) Slowly move the flap selector lever toward UP position; make sure that the stops at the outer hinges touch at the same time.Also make sure that inner and outer rigging lines move into alignment with the wing rigging lines simultaneously.

**CAUTION: DURING PARAGRAPH (6) THE AFT EDGE OF THE INNER FLAP LINE MUST NOT MOVE TO A POSITION WHERE IT IS IN FRONT OF THE FORWARD EDGE OF THE WING LINE EVEN WHEN THE FLAP UNIT INPUT LEVER IS FLUSH AGAINST THE UP STOP.**

(6) From the position where the inner and outer flap rigging lines are in alignment with the wing rigging lines, continue to move the flap selector lever to the UP position observing the rigging lines at the inboard hinge.

(7) Select flap from UP to TO, APP and LND positions; make sure that the flap position indicator, on the center instrument panel, shows the appropriate indication at each position.

(8) Set airbrake lever to SHUT position and flap lever to UP position. At the flap control unit, make sure that the face of the baulk latch is aligned with the face of the baulk lever.

(9) Set airbrake lever to OPEN position and flap lever to LND position. make sure that the face of the baulk latch is still aligned with the face of the baulk lever.

(10) Set airbrake lever to DUMP position. Make sure that baulk latch is released and does not stop the flap unit input lever as it moves towards the LIFT DUMP stop. Set airbrakes OPEN and make sure that the baulk lever and latch return to their initial positions automatically.

(11) Select flaps to UP and check that:

(a) Rigging marks on synchronizer unit cable spools are in alignment with those on body.

(b) Full groove on synchronizer unit actuating rod is just visible.

(c) Rigging mark on flap unit cut-off lever is aligned with rigging mark on body

(d) Rigging mark on transmitter gearbox pulleys aligns with guard pins

(e) Synchronizer cable tensions are 35-40 lb (Lower flaps; set tensiometer for 5 cwt cables and position it on cables adjacent to transmitters; raise flaps).

(12) Depressurize the hydraulic system.

(13) De-energize d.c. busbars (Chapter 24, GENERAL).

**B. Do a check of the flap range of movement** *(Figure 501 and Figure 503)*

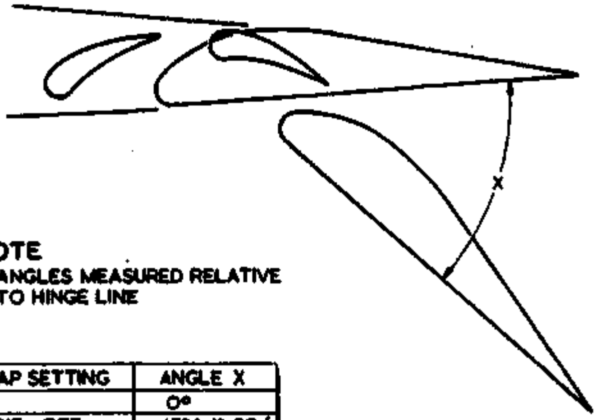
(1) Pressurize hydraulic system (Chapter 29, MAIN SYSTEM).

(2) Select flap lever to UP.

(3) Make sure that flap rigging lines align with lines on wing-mounted rigging plates.

*NOTE: The aft edge of inner hinge flap line must not lie forward of the forward edge of the wing line.*

(4) Position an inclinometer on each flap in turn aft of the outer hinge. Select flap lever to TO, APP and LND: make sure that flap movement and asymmetry between left and right flaps are in accordance with the limits shown.



NOTE
ANGLES MEASURED RELATIVE TO HINGE LINE

| FLAP SETTING | ANGLE X |
|---|---|
| UP | 0° |
| TAKE - OFF | $15^{\circ} \pm 1^{\circ} 30'$ |
| APPROACH | $25^{\circ} \, {}^{+1^{\circ} 30'}_{-2^{\circ}}$ |
| LAND | $45^{\circ} \pm 1^{\circ} 30'$ |
| LIFT DUMP | $75^{\circ} \, {}^{+1^{\circ} 30'}_{-2^{\circ}}$ |

1° MAXIMUM ASYMMETRY BETWEEN LEFT AND RIGHT FLAP AT ANY POSITION

Flap movements
*Figure 503*

(5) With flap lever at LND position, set airbrake lever to the LIFT DUMP position; check that the flap movement and asymmetry between left and right flaps are as shown. Set airbrake lever to SHUT and flap lever to LND.

(6) Manually operate flap unit input lever until the baulk arrests the input lever. Check that the flap angle is not more than 53°.

(7) Depressurize the hydraulic system.

**C. Do a check input circuit friction** *(Figure 501)*

(1) Make sure that cable tensions are correct (Paragraph1.).

(2) Remove connecting rod between input lever on flap control unit and lever on spring drum.

(3) Disconnect forward spring strut from flap cable drum. Set (by hand) the pulley drum to 'LIFT DUMP' position.

(4) Attach a spring balance to pulley *(Detail F)* and make sure that the force required to initiate movement of cable system is not more than 7 lb. This figure must not be greater between 'LIFT DUMP' and 'FLAPS UP' position.

(5) Remove spring balance and secure spring strut to flap cable drum.

(6) Reinstall connecting rod between input lever on flap control unit and lever on spring drum.

**D. Do a check of the function of spring strut.**

(1) Disconnect the spring strut from the cable pulley and the flap operating lever.

(2) Do the compression, expansion and break-out load checks for the spring strut, refer to the Component Maintenance Manual, Chapter 27-50.

(3) Connect the spring strut to the cable pulley and the flap operating lever.

(4) Lock all the items disconnected in paragraph (1)

(5) Do a functional test of the flap control system.

**E. Job Close up**

(1) Remove all the tools, the materials and equipment. Make sure the work area is clean.

## FLAP SPRING DRUM - MAINTENANCE PRACTICES

### 1. Unit servicing

For routine lubrication, refer to the Maintenance Schedule.

### 2. Removal/Installation

NOTE : Access to spring drum is gained through the access panel on the aft wall of the left-hand wheel well, and by removal of a cabin floor panel.

#### A. Remove flap spring drum

(1) Gain access to upper and lower parts of spring drum.

(2) Slacken cables at turnbuckles forward of pulley drums in fuselage. Remove cable guards from spring drum mounting and remove cable ends from pulleys.

(3) Disconnect connecting rod to flap control unit at lever on spring drum.

NOTE : Bolt head is retained in lever by circlip.

(4) Disconnect bolt securing lever to shaft of spring and withdraw lever.

(5) Remove bolts securing spring drum mounting to fuselage lower skin.

(6) From inside fuselage, remove bolts securing drum casting to supporting side structure.

(7) Remove spring drum and mounting assembly.

#### B. Install flap spring drum

Materials required :-

| | | | |
|---|---|---|---|
| JC5A jointing compound | .. | .. | DTD 900/4488 |

NOTE : Apply jointing compound under bolt heads, on washer and nut faces in contact with components, and on facing in contact with mounting.

(1) Position spring drum mounting in fuselage on the skin and between the supporting structure, locating spring drum shaft through the skin. Fit bolts and nuts to secure mounting, shimming as necessary on the left-hand attachment bolts to achieve alignment. Tighten nuts and bolts.

(2) Fit lever to spring drum shaft and secure with nut and bolt.

(3) Wind cables on spring drum pulley grooves and fit cable ends in correct slots (see Chapter 27, FLAP CONTROL SYSTEM). Fit and secure cable guards to drum mounting.

(4) Rig the flap control system from the control pedestal to spring drum (see Chapter 27, FLAP CONTROL SYSTEM).

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...Flap spring drum - Maintenance practices continued

(5) Fit and secure connecting rod from flap control unit to spring drum lever.

(6) Check rigging of flap system in accordance with the detailed procedure in Chapter 27, FLAP CONTROL SYSTEM. If full rigging requirements are not met it will be necessary to rig the system outboard of flap control unit.

(7) Fit and secure access panels in cabin and wheel well.

* * *

# FLAP CONTROL UNIT - DESCRIPTION AND OPERATION

## 1. Description

The Lucas flap control unit, Type 614, is basically a hydraulically driven power control for operating the wing flaps over their normal range and also over the lift-dump extension of flap travel at touch down.

The unit consists of the following main assemblies :-

Valve block (Fig.2), Hydraulic motor (Fig.3 and 4), Gearbox (Fig.4).

The valve block accommodates the hydraulic connections, relay valve assembly, cut-off valve assembly, filter, control input mechanism and baulk lever mechanism.

The hydraulic motor is a five cylinder, swashplate type unit mounted between the valve block and gearbox. Its output shaft engages the gearbox input shaft.

The gearbox consists of a normal reduction gear train through which rotation of the motor is transmitted to the flap transmission system. The gearbox output shaft also drives the resetter screw mechanism which causes the controlling relay valve to follow gearbox displacement.

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## 2. Operation

The unit operates the flaps over two separate stages :-

(1) Normal operation, i.e. input lever movement between the flaps up stop and a point 0.030 in. before the latch stop. This gives a flap displacement of 50°.

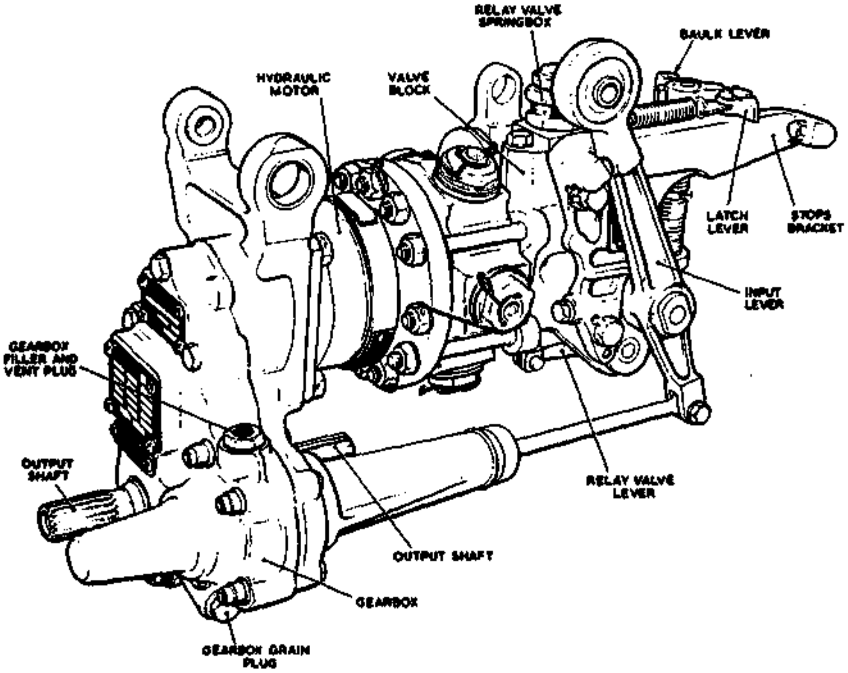
(2) Lift-dump selection, i.e. the remainder of the input lever travel to the maximum limit stop. This gives a further flap displacement of 25°.

The main diagram on Fig.5 shows the flap control with the input lever displaced to start control output. Output continues until the input lever is stationary and the resetter drive has closed the relay valve.

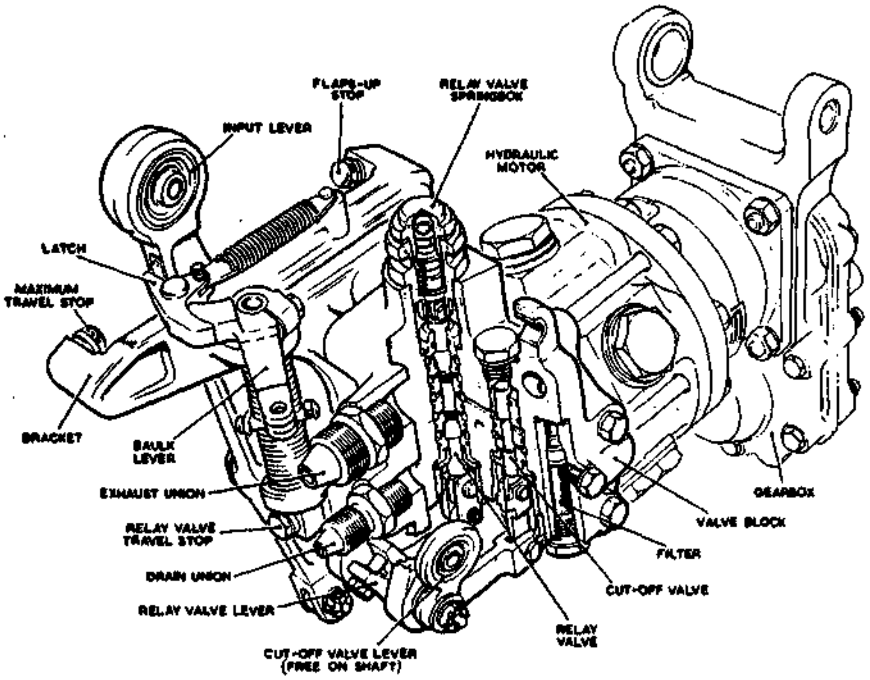
### A. Normal operation

When flaps down is selected, this loads a springbox in the input transmission which then continues to displace the input lever until the required flap angle is achieved.

The input lever is displaced about fulcrum A, causing fulcrum B and its lever to rotate about shaft C on to stop D, and move the relay valve through its operating lever. Movement of the relay valve initiates rotation of the hydraulic motor which drives the output shaft of the gearbox through the gear train. The output shaft also rotates the resetter gear and nut which in turn produces linear displacement of the resetter link. This displacement moves the input lever about point E (connection to input linkage) in the direction which tends to return the relay valve to the closed position. Continued displacement at E will fractionally precede that of the resetter link, thus allowing the relay valve to remain



Flap control unit Type 614
Fig.1



Valve block
Fig.2

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open until displacement at E is stopped, just short of the latch stop, by the springbox in the input transmission. During normal operation stops D and F limit movement of the relay valve, for flaps down and up respectively, to control the rate of operation.

Unwanted flap displacement into the lift-dump range, which could be caused by a sticking relay valve, is prevented by the latch stop. Should the valve stick and cause the motor to continue rotating, this would arrest movement of the input lever at point E and force the resetter screw to close the relay valve.

### B. Hydraulic circuit

High pressure hydraulic fluid enters the unit through the inlet non-return valve and passes through the filter and cut-off valve to the relay valve. Movement of the relay valve from the closed position connects one motor port to supply pressure and the other to exhaust, depending on which direction the valve is moved, thus initiating rotation of the hydraulic motor. The cut-off valve is linked to position receiver Type 617 and only operates to intercept the flow, and stop the unit, in response to a flap asymmetry signal from the receiver. The springbox attached to the relay valve ensures that the valve closes automatically should failure occur in the input linkage system.

### C. Hydraulic Motor

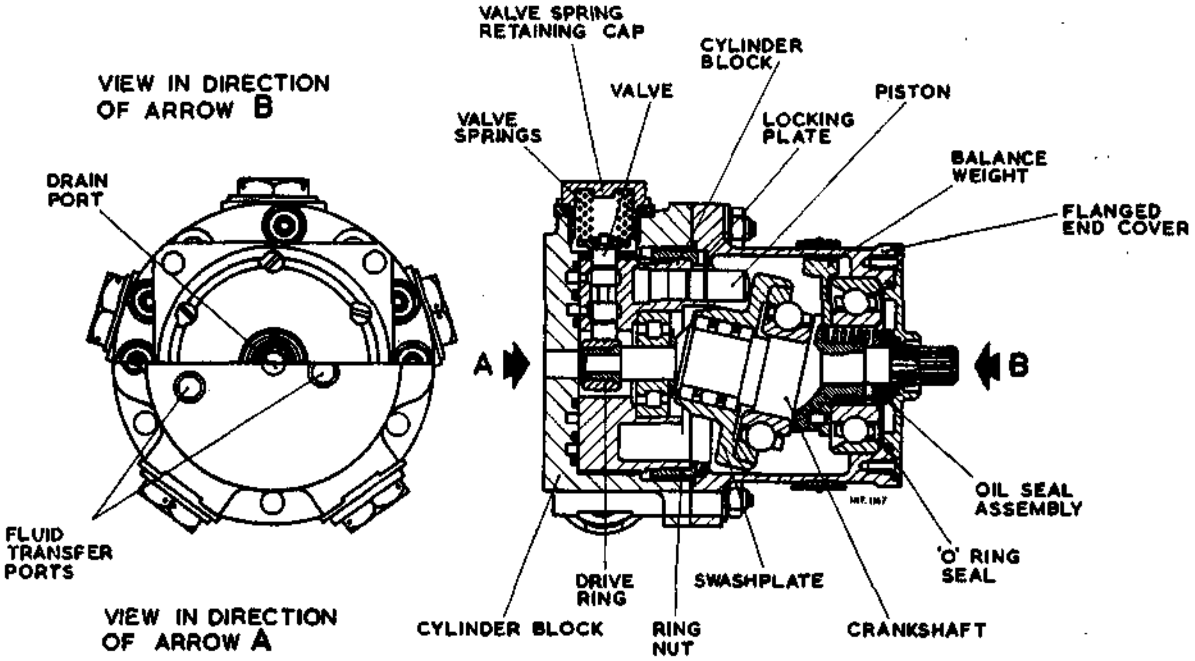
Fluid is directed by the relay valve to one of the two ports controlled by each motor valve, the other port to each valve being connected to exhaust. The valves are operated by a driving ring on the shaft eccentric and their timing relative to the pistons is such that when a piston is at the extremity of its travel in either direction, the inlet and exhaust ports are closed.

When a piston is on its driving stroke, the valve is open to inlet pressure and, conversely, when a piston is on its return stroke, the valve is open to exhaust. It is the reversal of the inlet and exhaust pressure, as selected by the relay valve, that produces a reversal in the direction of rotation.

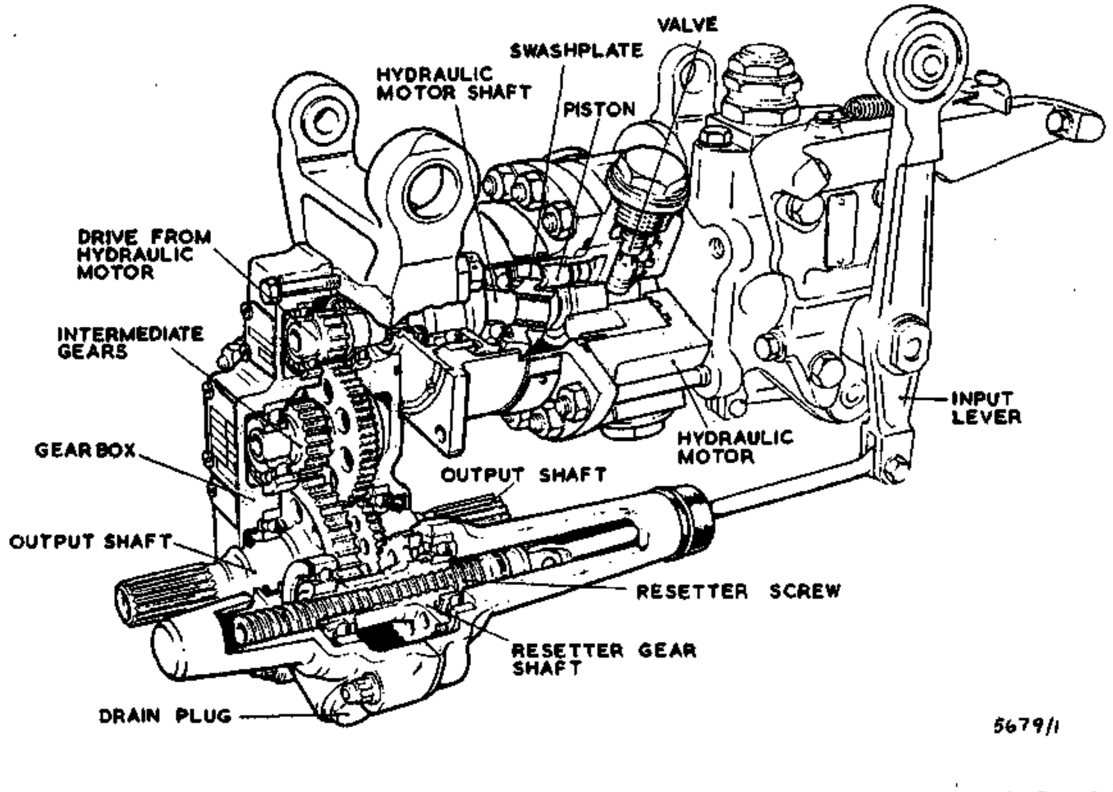
Thrust applied by a piston is transmitted through the swashplate to the inclined crankpin, forcing the crankshaft to turn within the swashplate. Thrust is applied by each piston in turn so that any given point on the swashplate completes one reciprocal displacement during one revolution of the shaft. The pistons and valves are not mechanically connected, and the pistons have convex outer ends to correspond with the angular changes of the swashplate.

### D. Lift-dump selection

An extension of 25° flap travel is provided to perform the lift-dumping operation which increases drag at touchdown. When this is selected the torsion spring-loaded baulk lever is displaced in the direction of arrow G and disengages the baulk stop, thus allowing the input lever to displace the latch stop and be moved to the maximum limit stop. Simultaneously, the valve travel stop D attached to the baulk lever shaft is rotated out of contact with the shaft of fulcrum B.



Hydraulic motor Type Y 855 Mk.4
Fig.3



Gearbox and hydraulic motor
Fig.4

thus giving an increase in relay valve opening and consequently an increase in flap rate during the lift-dump sequence. The spring-loaded latch allows the input lever to ride past it when returning from the lift dump position.

E. Emergency operation

The emergency inlet union provides a connection for a hand pump emergency supply for use in the case of main hydraulic supply failure. Both inlet connections embody a non-return valve.

F. Data

| | |
|---|---|
| Hydraulic motor | Integral Type Y.855 |
| Hydraulic supply fluid | DTD.585 |
| Hydraulic supply pressure (normal) | 3000 lb/in$^2$ |
| (maximum - surge) | 3400 lb/in$^2$ |
| Lubricating oil for gearbox | DTD.585 |
| Grease | DTD.866, 844 or 5598 |
| Output revs. | |
| Normal operation | 25.75 to 26.25 |
| Total travel | 35.5 to 36.5 |
| Operating time (flaps extending) | |
| Normal operation (pre.mod.252208) | 10 to 12 seconds |
| " " (mod.252208) | 14 to 16 seconds |
| Lift dump operation | 2 seconds |
| Weight (wet) | 14.7 lb. |

Fig. 5 overleaf

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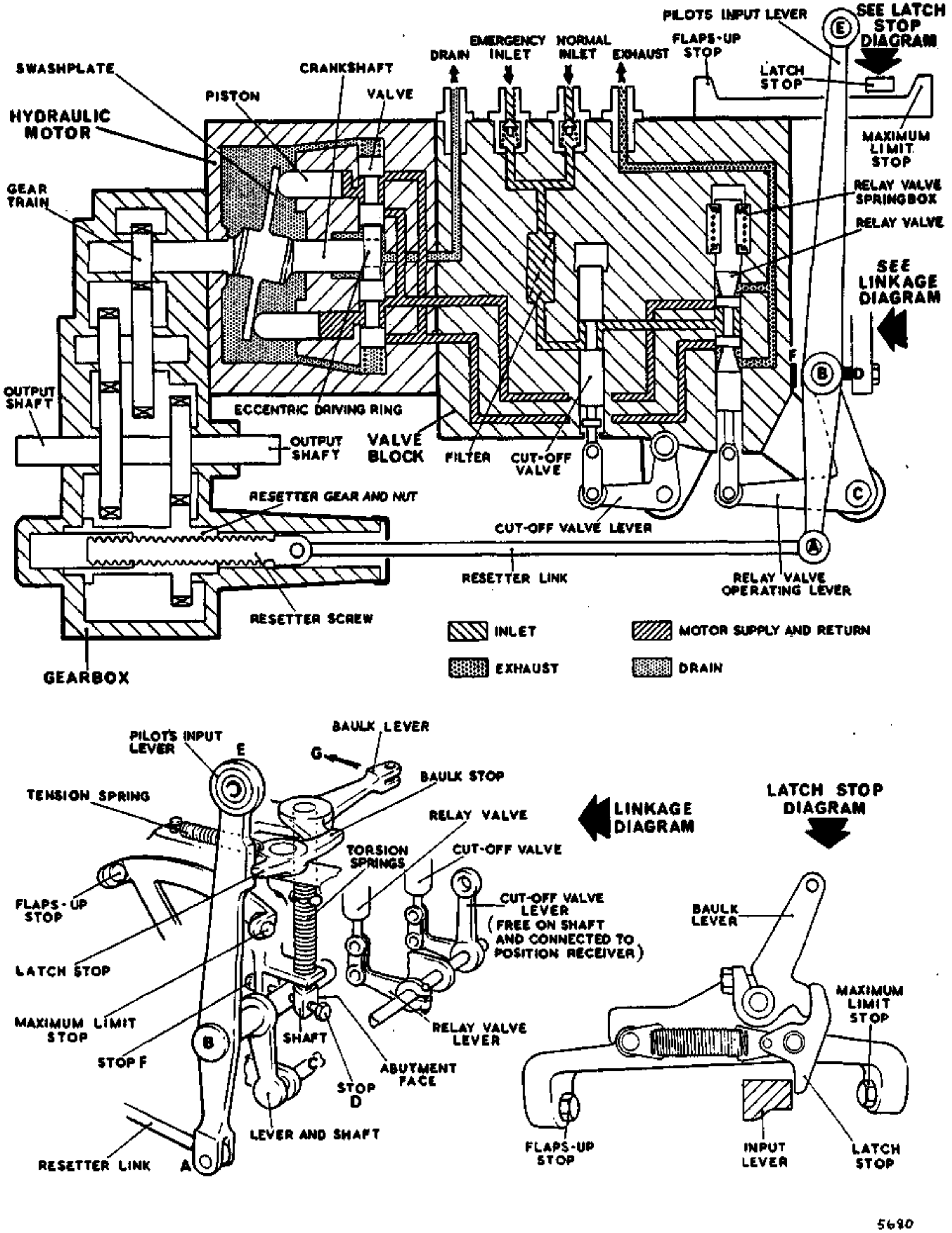

Functional diagram
Fig.5

*　　*　　*

## FLAP CONTROL UNIT - TROUBLE SHOOTING

| Fault | Possible cause | Remedy |
|---|---|---|
| Output failure (main supply) | Failure of hydraulic supply | Check supply |
| | Failure of hydraulic motor | |
| | Breakage of internal component | Remove unit for rectification |
| Output failure (emergency supply) | Failure of emergency supply (See also main supply failure for other items) | Check supply |
| Unit sluggish or low output rate | Insufficient flow from supply | Check supply |
| | Faulty seal | Remove unit for rectification. |
| | Choked filter | Check filter. Renew if choked. |
| | Stiff input lever mechanism or relay valve | Isolate unit from linkage and check input lever. If heavy, remove unit for rectification. |
| Excessive backlash in complete unit. | Wear in output splines | Check splines for wear. If necessary, remove unit for rectification. |
| | Overall wear in gearbox. | Remove unit for rectification . |
| Loss of sensitivity | Backlash in input linkage. | Isolate unit and trace fault in input linkage. |
| Noisy gearbox | Oil level low | Check level. Top up if necessary. Check for leakage. If level was low, re-check for leakage after next flight. |
| | Wear of gears )<br>)<br>Faulty bearings ) | Remove unit for rectification. |

continued

...Flap Control Unit - Trouble shooting continued

| Fault | Possible cause | Remedy |
|---|---|---|
| Oil leakage from hydraulic motor flanges. | Faulty seals | Remove unit for rectification. |
| Oil leakage from pipeline unions, breather valve or drain plug. | Faulty seals | Renew if accessible, otherwise remove unit for rectification. Re-lock. |

* * *

## FLAP CONTROL UNIT - MAINTENANCE PRACTICES

### 1. Unit servicing

#### A. Replenish oil in control unit gearbox

(1) With control unit installed or with unit in installed attitude (with mounting lugs uppermost) remove gearbox filler and vent plug and ensure that oil is to this level. Replenish, if necessary, using oil DTD 585.

CAUTION : REMOVE GEARBOX FILLER AND VENT PLUG CAREFULLY. ITS VALVE IS SPRING LOADED AND OIL MAY BE PRESSURIZED.

(2) Fit gearbox filler and vent plug; tighten and wire-lock.

### 2. Removal/Installation

Materials required :-

| | |
|---|---|
| Grease .. .. .. | DTD 5609 |

#### A. Remove flap control unit

(1) Pressurize hydraulic system (see Chapter 29, MAIN SYSTEM) and select flaps 0°. When flap movement ceases, release system pressure.

(2) Gain access to flap control unit through aft inner wall panel of left-hand wheel well.

(3) Disconnect connecting rod from synchronizer unit at the flap control unit cut-off valve lever.

(4) Disconnect connecting rod from spring drum at flap control unit input lever.

(5) Disconnect airbrake cable from baulk lever at flap control unit as follows :-

(a) Unscrew and remove the tension rod securing the cable opposite end to the bellcrank lever at the airbrake cable.
(b) Slacken locknut and disconnect screwed end from fork-end coupling on unit baulk lever.

(6) Remove torque tubes from control unit output shafts (see Chapter 27, FLAP DRIVE SHAFTS).

(7) Release pressure from hydraulic system (see Chapter 29, MAIN SYSTEM).

(8) Place a suitable container beneath the control unit, and then remove the hydraulic pipes from the control unit adapters. Wipe off any spilt fluid immediately.

(9) Support control unit bracket. Remove bolt securing control unit to mounting bracket.

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...Flap control unit - Maintenance practices continued

(10) Fit blanks to pipe ends and control unit adapters.

B. Checks/Tests before installation

(1) Examine control unit exterior for evidence of damage, corrosion, oil leakage, and security of all locking devices.

(2) Remove blanks or masking from gearbox filler and vent plugs.

(3) Check oil in control unit gearbox, if necessary correct oil level, (see para.1.A.) Units are stored with gearboxes completely filled and will require partial draining before installation.

C. Install flap control unit

(1) Position control unit in aircraft and align unit mounting lugs with holes in mounting bracket. Fit bolt (ensuring that head circlip locks in lug bush), washer and nut; do not tighten at this stage.

(2) Move control unit to align unit bracket with hole in support link. Fit bolt, ensuring that head circlip locks in link bush. Fit washer and nut. Tighten nut and lock with split pin.

(3) Tighten nut on bolt fitted in operation (1) and lock with split pin.

(4) Remove blanks from pipe ends and fit and secure pipes to unit adapters.

(5) Liberally lubricate control unit output shafts with grease and fit and secure torque tube drive shafts (see Chapter 27, FLAP DRIVE SHAFTS).

(6) Fit connecting rod, from spring drum lever, to flap control unit input lever. Fit bolt, with head forward, and attach nut. Tighten nut and lock with split pin.

NOTE : If connecting rod requires adjustment see Chapter 27, FLAP CONTROL SYSTEM - for rigged position of levers.

(7) Fit connecting rod, from synchronizer gear box, to the cut-off valve lever on the flap control unit. Fit bolt and nut. Tighten nut and lock with split pin.

NOTE : If the connecting rod requires adjustment see Chapter 27, FLAP CONTROL SYSTEM - for rigged position of levers.

(8) Fit airbrake cable to baulk lever on flap control unit :-

(a) Fit locknut to baulk cable screwed end and fit screwed end into fork-end coupling on baulk lever.
(b) Couple tension rod to opposite end of baulk cable and to the fork-end coupling on the airbrake cable bellcrank lever.

...Flap control unit - Maintenance practices continued

(9) Rig the lift dump mechanism and check rigging of the flap system (see Chapter 27, FLAP CONTROL SYSTEM).

(10) Functionally test the flap control system (see Chapter 27, FLAP CONTROL SYSTEM).

NOTE : During test check that the minimum clearance between the flap control unit input lever and adjacent left-hand engine fuel feed pipe is not less than 0.15 in. over the full range of flap travel.

(11) Replenish hydraulic system reservoir, as necessary (see Chapter 12, HYDRAULIC).

* * *

## FLAP DRIVE SHAFTS - MAINTENANCE PRACTICES

### 1. Unit servicing

For routine lubrication, refer to the Maintenance Schedule.

### 2. Removal/Installation (Fig.201)

NOTE : To avoid post-installation rigging, flap drive shafts and control components should not be moved or rotated whilst parts of the system are disconnected.

#### A. Remove torque tube drive shafts

NOTE : All torque tubes are of similar construction and method of removal and installation is the same. Access to the outer torque tubes is with the flaps down and access to the inner torque tubes is through the aft wall of the wheel wells. Mod. 252031 introduces waxed string for securing gaiters and grease retaining seals to the shafts and couplings.

(1) Gain access to torque tube.

(2) Remove bolts from flange coupling.

NOTE : To avoid post-installation rigging, note the position of bolt holes in flange coupling and mating component.

(3) Slacken hose clip securing grease retaining seal on other end of torque tube. Clear flange coupling and withdraw tube carefully from component serrated end to prevent damage to grease retaining seal. Remove seal.

#### B. Checks/Tests before installation

(1) Ensure that the Mollart joints are well packed with grease DTD.5609 before assembly.

(2) Examine Mollart joint grease covers and torque tube end grease retaining seals for evidence of deterioration.

#### C. Install torque tube drive shafts

(1) Liberally lubricate torque tube end inner serrations, and component serrated male connection with grease DTD.5609.

(2) Position grease retaining seal (and hose clip if pre mod. 252031) on end of torque tube.

(3) Fit torque tube end on serrated end of component ensuring correct positioning of grease retaining seal.

(4) Align flanged coupling bolt attachment holes with those on component flange. Fit bolts, washers and nuts. Tighten nuts and lock with split pins.

(5) Pre mod. 252031 : Tighten hose clip on grease retaining seal.

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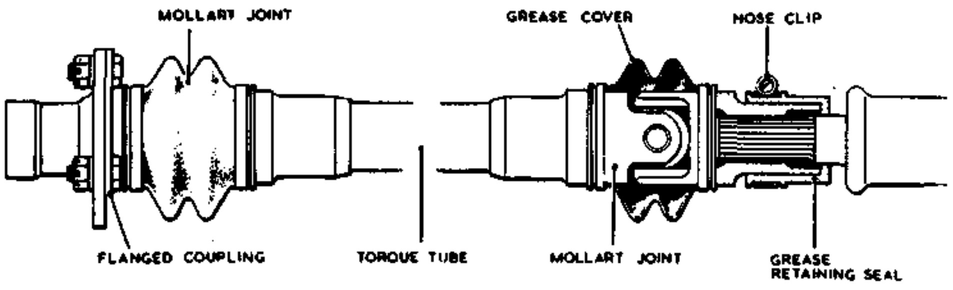
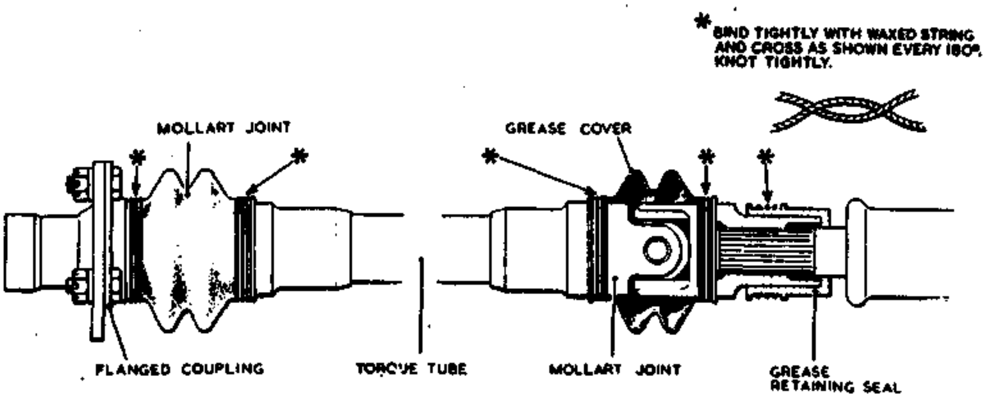
...Flap drive shafts - Maintenance practices continued



PRE MOD. 252031 INSTALLATION



MOD. 252031 INSTALLATION

Torque tube-installation details
Fig. 201

(6) Mod. 252031 only : Secure grease retaining seal with waxed string; bind tightly and cross string at every 180° (see Fig. 201) and knot tightly. No less than three complete turns must be used. Knot tightly when completed.

(7) Functionally test flaps control system (see Chapter 27, FLAP CONTROL SYSTEM).

(8) Fit and secure access panels in wheel well wall, where applicable.

* * *

# BEVEL DRIVE ASSEMBLIES – MAINTENANCE PRACTICES

## 1. Procedure

### A. In-situ bevel gear backlash check *(Figure 201)*

(1) Hold the bevel gear assembly output shaft and rotate the bevel gear assembly flanged coupling. Make sure that the total permissible backlash in the bevel gears, measured at a flanged coupling bolt, is not more than 0.020 in.

### B. Removal *(Chapter 27-50-131, Figure 201)*

(1) Get access to the bevel gear assemblies with the flaps down and the wheelwell rear panels removed.

(2) Draw a reference line across the bevel drive and torque shaft flanged couplings. Draw a reference line across the bevel drive housing and the splined end.

(3) Remove the 6 nuts, washers and bolts that secure the bevel drive flanged coupling to the inboard torque shaft flanged coupling.

(4) Remove the 4 bolts and washers that secure the bevel drive assembly to the aircraft structure.

(5) Support the bevel gear assembly and slide its splined end out of the outboard torque shaft grease retaining seal.

### C. Inspection/check

(1) For inspection/check and internal lubrication of the bevel gear assemblies refer to the Component Maintenance Manual, Chapter 27-50-131.

### D. Installation

(1) Slide the bevel gear assembly splined end into the outboard torque shaft grease retaining seal.

(2) Position the bevel gear assembly on the aircraft structure and secure with the 4 bolts and washers.

(3) Align the reference lines which were drawn in paragraph B.(2).

(4) Fit the 6 nuts, washers and bolts that secure the bevel drive flanged coupling to the inboard torque shaft flanged coupling.

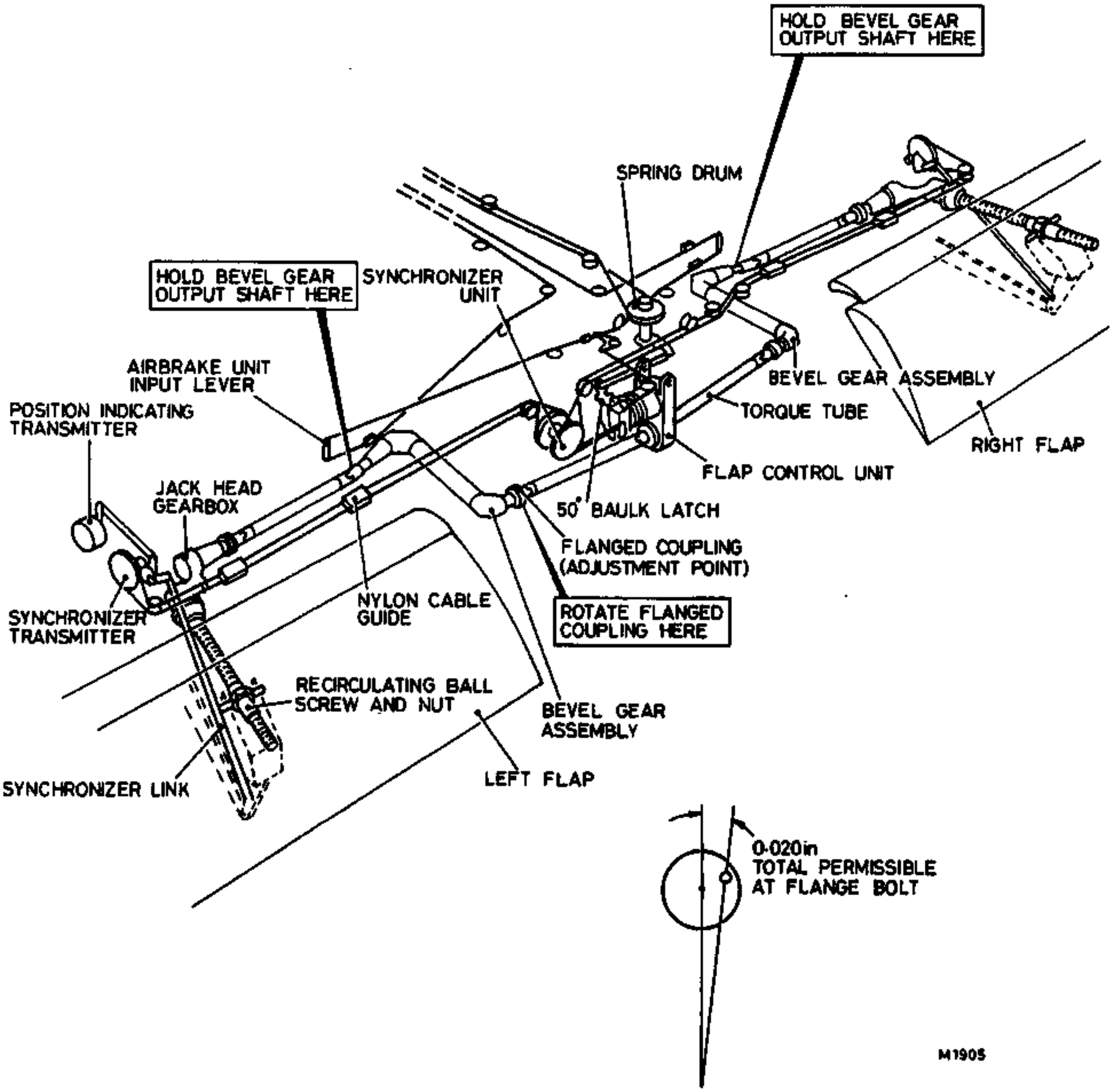
(5) Lock all items removed in paragraphs B.(3) and (4).

### E. Rigging and functional check of the flap system

(1) Check the rigging of the flap system (Chapter 27, FLAP CONTROL SYSTEM).

(2) Do a functional check of the flap system (Chapter 27, FLAP CONTROL SYSTEM).

(3) Install the wheelwell rear panels.


HOLD BEVEL GEAR OUTPUT SHAFT HERE
SPRING DRUM
HOLD BEVEL GEAR OUTPUT SHAFT HERE
SYNCHRONIZER UNIT
AIRBRAKE UNIT INPUT LEVER
POSITION INDICATING TRANSMITTER
BEVEL GEAR ASSEMBLY
TORQUE TUBE
RIGHT FLAP
FLAP CONTROL UNIT
JACK HEAD GEARBOX
50° BAULK LATCH
FLANGED COUPLING (ADJUSTMENT POINT)
NYLON CABLE GUIDE
ROTATE FLANGED COUPLING HERE
SYNCHRONIZER TRANSMITTER
RECIRCULATING BALL SCREW AND NUT
BEVEL GEAR ASSEMBLY
LEFT FLAP
SYNCHRONIZER LINK
0.020in TOTAL PERMISSIBLE AT FLANGE BOLT
M1905

Bevel gear assemblies
*Figure 201*

## FLAP SCREWJACK AND REDUCTION GEARBOX - MAINTENANCE PRACTICES

### 1. Unit servicing

For routine lubrication refer to the Maintenance Schedule.

#### A. Replenish screwjack body with oil (Fig.201)

Materials required:

| | | | |
|---|---|---|---|
| Oil | .. | .. | MIL-H-5606 or DEF.STAN.91-48 |

CAUTION: MAKE CERTAIN TRAVEL RANGE OF CONTROL SURFACES IS CLEAR.

(1) Pressurize hydraulic system (see Chapter 29, MAIN SYSTEM). Select flaps 45 deg. and airbrake lever to the DUMP position. When flap movement ceases, release system pressure.

(2) Remove forward fairings from flap inboard hinges.

(3) Cut wirelocking and remove filler plug from flap screwjack.

(4) Cut wirelocking and loosen screwjack drain plug. Position a suitable container and remove drain plug to drain oil from screwjack.

(5) Fit, tighten and wirelock drain plug. Using a suitable syringe, fill the screwjack with approximately 35 millilitres of oil.

(6) Fit, tighten and wirelock filler plug.

(7) Position and secure flap hinge fairings.

(8) Using ground servicing handpump, select and move flaps fully up.

### 2. Removal/Installation

Note: To avoid post-installation rigging, the flap drive shafts should not be rotated while disconnected.

#### A. Remove flap screwjack and reduction gearbox

CAUTION: MAKE CERTAIN TRAVEL RANGE OF CONTROL SURFACES IS CLEAR.

(1) Pressurize hydraulic system (see Chapter 29, MAIN SYSTEM). Select flaps 45 deg. and airbrake lever to DUMP position. When flap movement ceases, release system pressure.

(2) Support flap in the DUMP position with trestles aft of each hinge at flap trailing edge.

(3) Remove fairing from flap inboard hinge arm.

(4) Disconnect outer torque tube at flanged coupling on bevel housing (see Chapter 27, FLAP DRIVE SHAFTS).

(5) Disconnect bonding wire.

(6) Remove bolts and sideplates securing screwjack nut housing to flap hinge arm.

(7) Take weight of jack and unscrew nut securing special bolt to trunnion. Withdraw bolt, and remove jack from aircraft. Retain thrust washers.

Note: To avoid removing fail-safe stop plate, withdraw bolt whilst unscrewing the securing nut. Head of bolt is retained in jack end by a circlip.

## B. Check/Test before installation

Materials required:

| | | | |
|---|---|---|---|
| Grease | .. | .. | MIL-G-25537A (DTD 5609) |
| Oil | .. | .. | MIL-H-5606 (DEF STAN 91-48) |

(1) Cut wirelocking and remove filler and drain plugs from screwjack body, drain oil into a suitable container. Fit, tighten and wirelock drain plug.

(2) Using a suitable syringe, fill the screwjack with approximately 35 millilitres of oil.

CAUTION: DO NOT ATTEMPT TO FILL ABOVE THIS LEVEL BY ROTATING BODY OF SCREWJACK.

(3) Fit, tighten and wirelock filler plug.

(4) Examine flap screwjack and reduction gearbox for security of attachments and locking devices. Check backlash between flap screwjack nut assembly and jack screw shaft. If backlash is 0.02 in. or more, the nut assembly must be reballed (refer to Overhaul Manual).

(5) Lubricate thrust washers at trunnion pins on jack body, trunnion fitting on wing at jack attachment point, and jack nut housing on screw shaft with grease.

## C. Install flap screwjack and reduction gearbox

Materials required:

| | |
|---|---|
| Grease .. .. | MIL-G-25537A (DTD 5609) |

(1) Position screwjack body and attachments over wing trunnion fitting. Smear special bolt with grease and insert through jack body attachments and trunnion fitting. Fit washer and nut; lock circlip on head of bolt in jack fitting. Tighten nut and lock with split pin.

Note: To avoid removing fail-safe stop plate, fit washer and nut on bolt before fully fitting bolt.

(2) With flap retained in the DUMP position (operations 2,A,(1) and (2)) move nut housing down screw shaft until stop on housing and shaft end contact. Turn housing back up shaft 1/4 turn minimum until housing trunnion pins are horizontal.

Note : To ensure housing does not contact shaft stop. The flap unit input lever 75 deg. stop can be adjusted (shimmed) to provide a minimum gap of 0.050 in. between housing and shaft stops.

(3) Locate side plates on trunnion pins of nut housing and align side plate bolt holes with those on the flap hinge arm. Secure side plates to hinge arm with bolts, washers and nuts; tighten nuts and lock with split pins

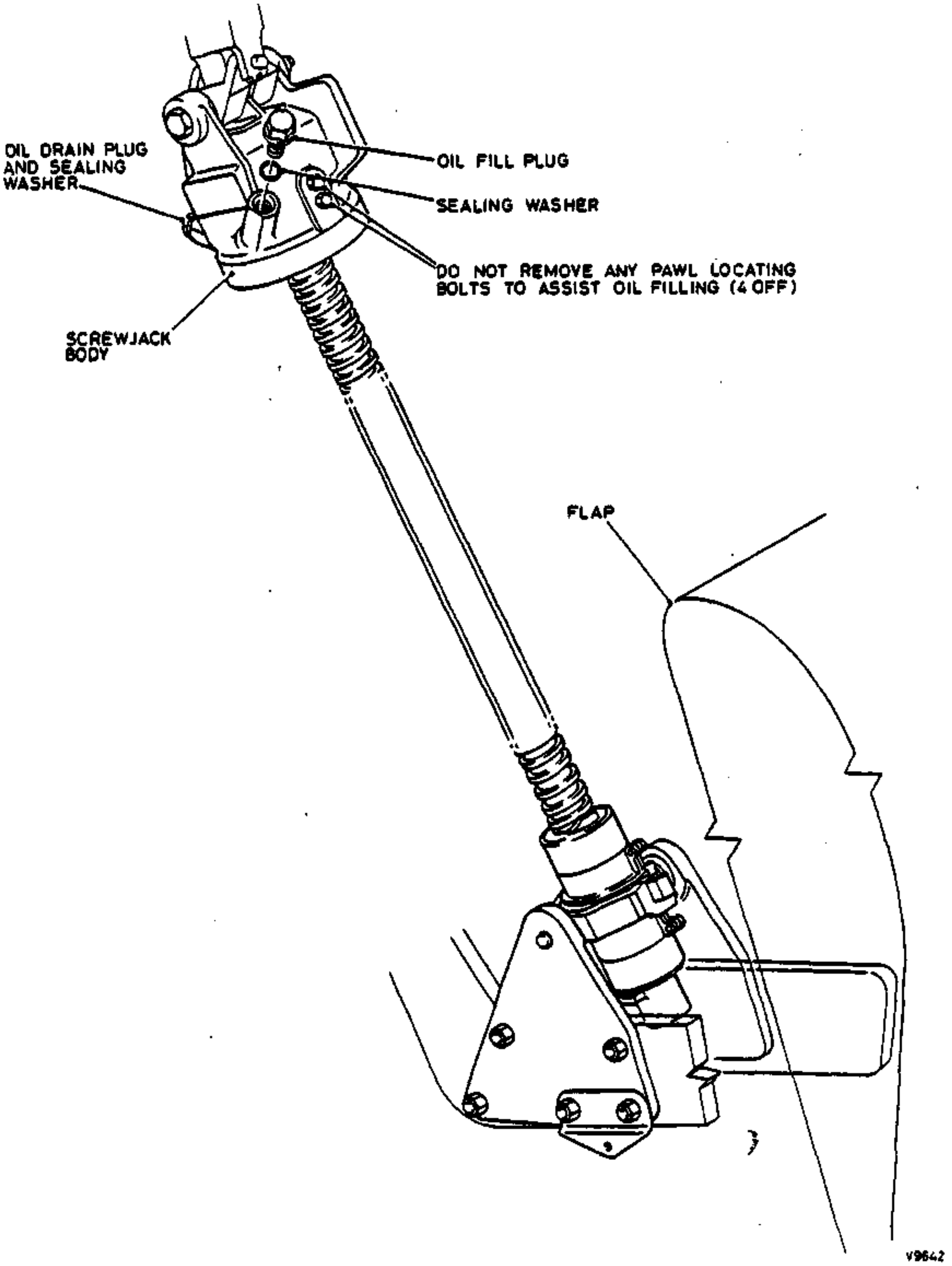
(4) Fit and secure the outer torque tube to the gearbox flanged coupling (see Chapter 27, FLAP DRIVE SHAFTS).

(5) Connect bonding wire to the forward upper bevel housing bolt (see 20-10-5016 Electrical Bonding). Make certain the bonding wire does not obstruct the free movement of the flap torque tube throughout full flap travel.

(6) Fit and secure fairing to flap inboard hinge arm.

(7) Remove supporting trestles from flap.

(8) Functionally test flaps control system (see Chapter 27, FLAP CONTROL SYSTEM).


OIL DRAIN PLUG AND SEALING WASHER
OIL FILL PLUG
SEALING WASHER
DO NOT REMOVE ANY PAWL LOCATING BOLTS TO ASSIST OIL FILLING (4 OFF)
SCREWJACK BODY
FLAP
V9642

Screwjack filling points
Fig.201

* * *

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# FLAPS - MAINTENANCE PRACTICES

## 1. Unit servicing

For routine lubrication, refer to the Maintenance Schedule.

## 2. Removal/Installation

| Equipment/Material | Part/Item No. |
|---|---|
| Grease, general purpose | 040 (Chapter 20-95-11) |
| Grease, low temperature | 078 (Chapter 20-95-11) |

### A. Remove flap (left or right)

(1) Pressurize hydraulic system or use the airplane ground servicing pump on the rear equipment bay. Select flaps LND and airbrake lever to DUMP. When flap movement ceases, release system pressure (Chapter 29, MAIN SYSTEM).

(2) Remove fairings from the inner and outer hinge arms.

(3) Support flap in the DUMP position with trestles aft of each hinge at flap trailing edge.

(4) Remove bolts and sideplates securing flap screwjack nut housing to the inner flap hinge arm.

(5) Remove nut and disconnect synchronizer gearbox cranked lever from attachment fitting on flap inner hinge arm.

(6) Support flap and remove bolts securing flap inner and outer hinge arms to the fixed hinge arms.

(7) Remove flap from wing.

### B. Install flap (left or right) *(Figure 201)*

(1) Locate flap below wing, aligning flap hinge arms with fixed arms on wing.

(2) Install bonding leads under the head of each bolt (Chapter 20, ELECTRICAL BONDING). Apply low temperature grease Item 078, and insert bolts through flap hinge arms and fixed hinge arms, and install washers and nuts. Make sure that bonding leads are positioned so that they will not chafe the hinge arms during flap movement, then tighten nuts and lock with split pins.

(3) Lubricate trunnion pins on flap screwjack nut housing with general purpose grease Item 040. With flap retained in the DUMP position, move nut housing down screwed shaft until stops on housing and shaft end contact. Turn housing back up shaft 1/4 turn minimum until housing trunnion pins are horizontal.

(4) Locate side plates on trunnion pins of nut housing and align side plate bolt holes with those on flap hinge arm. Secure plates to hinge arm with bolts, washers and nuts; tighten nuts and lock with split pins.

(5) Position synchronizer gearbox cranked lever on flap attachment fitting. Liberally lubricate fitting with grease Item 078. Install cranked lever to fitting; secure with special nut and lock with split pin.

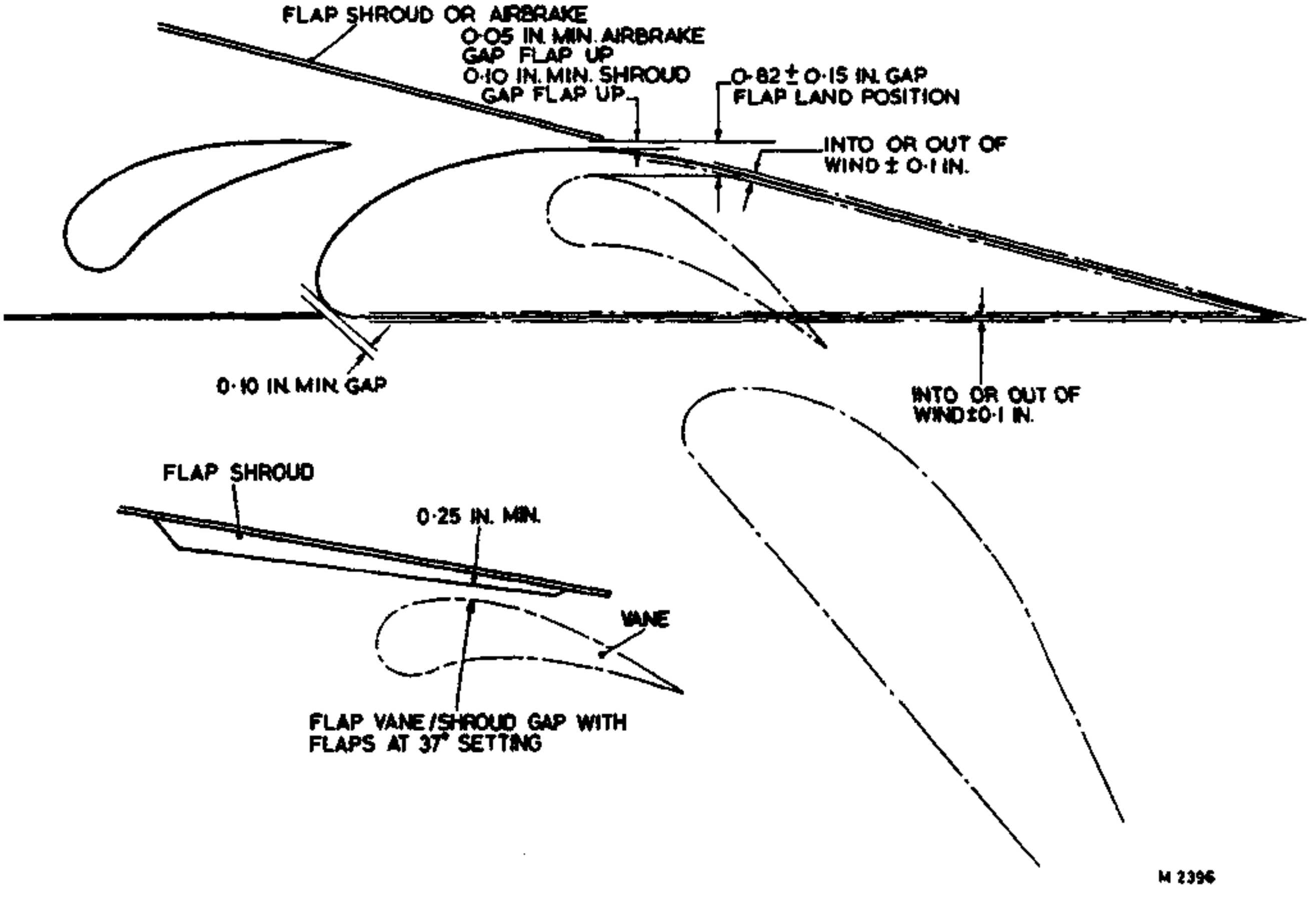
(6) Remove supporting trestles and rig the flap outboard of control unit (Chapter 27, FLAP CONTROL SYSTEM).

(7) Install and secure fairings to flap hinge arms and wing.

(8) Do a functional test of the flap control system (Chapter 27, FLAP CONTROL SYSTEM).

(9) Using the hydraulic system handpump, check flap clearances are within the limits shown in. Pay particular attention to the flap vane/shroud gap minimum clearance at flap settings between 25° and 45°.

*NOTE: The point at which the flap vane/shroud gap is most minimal is at a flap setting of 37 degrees approximately. Should the minimum clearance be less than that required, adjust gap by inserting packing as in paragraph C.*


FLAP SHROUD OR AIRBRAKE
0·05 IN. MIN. AIRBRAKE GAP FLAP UP
0·10 IN. MIN. SHROUD GAP FLAP UP
0·82 ± 0·15 IN. GAP FLAP LAND POSITION
INTO OR OUT OF WIND ± 0·1 IN.
0·10 IN. MIN. GAP
INTO OR OUT OF WIND±0·1 IN.
FLAP SHROUD
0·25 IN. MIN.
VANE
FLAP VANE/SHROUD GAP WITH FLAPS AT 37° SETTING
M 2396

Flap clearances
*Figure 201*

### C. Removal/Installation of flap vane

Refer to Overhaul Manual for removal and installation of flap vane.

## 3. Adjustment/Test

### A. Flap shroud adjustment *(Figure 201, Figure 202)*

If an airtest shows that a wing drops on selection of flaps to LAND position, this condition can be corrected by adjustment of the opposite wing outboard upper flap shroud as follows:

(a) Insert packing pieces, locally manufactured as shown, *(Figure 202)* between 'P' flanges of ribs and shroud.

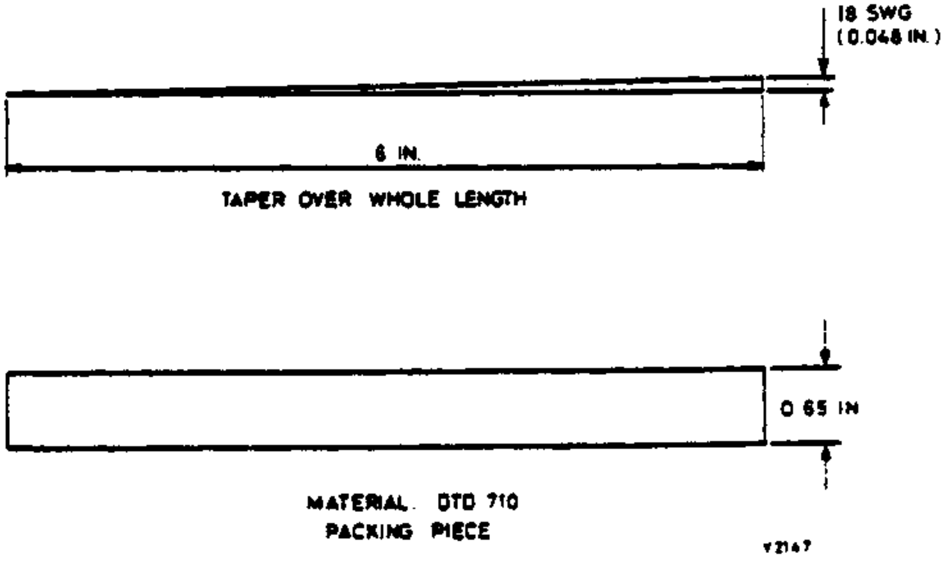
(b) Attach packing, maximum thickness of three (3) pieces, to ribs using 1/16 in. diameter counter-sink head rivets spaced approximately one inch apart.

(c) Adjust the upper airbrake until it is within alignment tolerances with re-positioned shroud.

The above procedure to be repeated until stability is achieved with the clearances maintained. *(Figure 201)*

*NOTE: If it is necessary to replace a flap the above setting may require re-adjustment.*

*NOTE: Record total packing thickness in aircraft Log Book.*



Packing piece - shroud adjusting
*Figure 202*

# RECEIVER UNIT - DESCRIPTION AND OPERATION

## 1. Description (Figs. 1 and 3)

The Hobson position receiver, Type 617, is basically a differentially - geared actuator which, in response to flap position signals, prevents asymmetric positioning of the flaps.

The differential gear assembly is rotated by cable spools which receive the signals. In the event of a breakage in the flap transmission system, hydraulic power to the flap control unit is stopped through a mechanical link between the receiver actuator and a cut-off valve in the control unit.

Mk. 2, 3 and 4 units have an angled extension of one pulley for the Mod. 251903 installation.

## 2. Operation (Figs. 2 and 4)

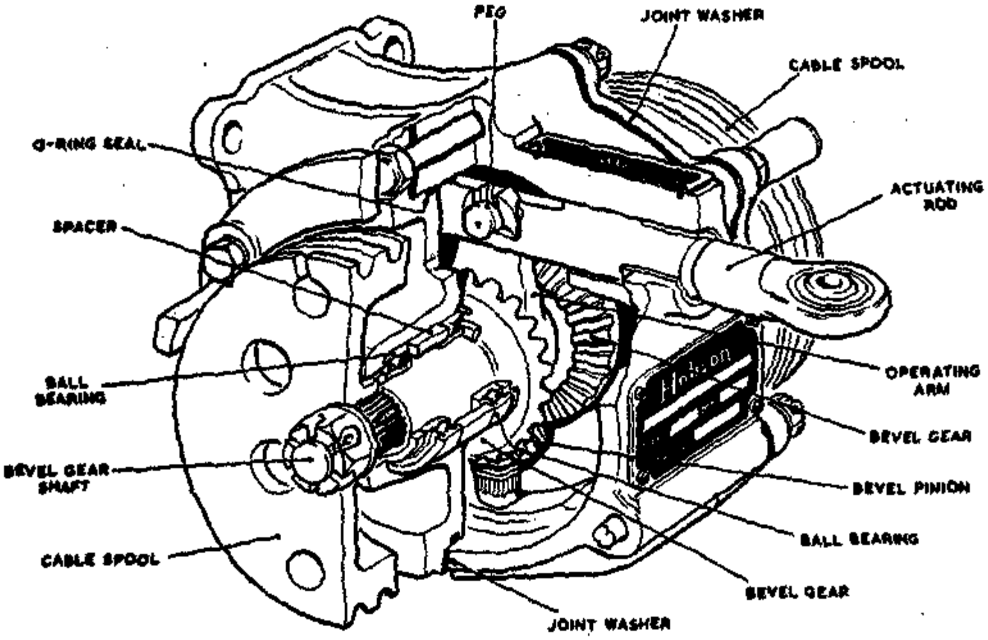
When the cable spools are contra-rotating at identical speeds, the bevel pinion and central operating arm maintain a neutral position within the differential gear assembly. The actuating rod is also retained in a neutral position by the central operating arm.

If a speed differential is applied to the spools, due to transmission failure and consequent asymmetric positioning of the flaps, the bevel pinion is angularly displaced and the central operating arm moves the actuating rod in the appropriate direction. Movement of the actuating rod closes the cut-off valve in the control unit and flap operation ceases.

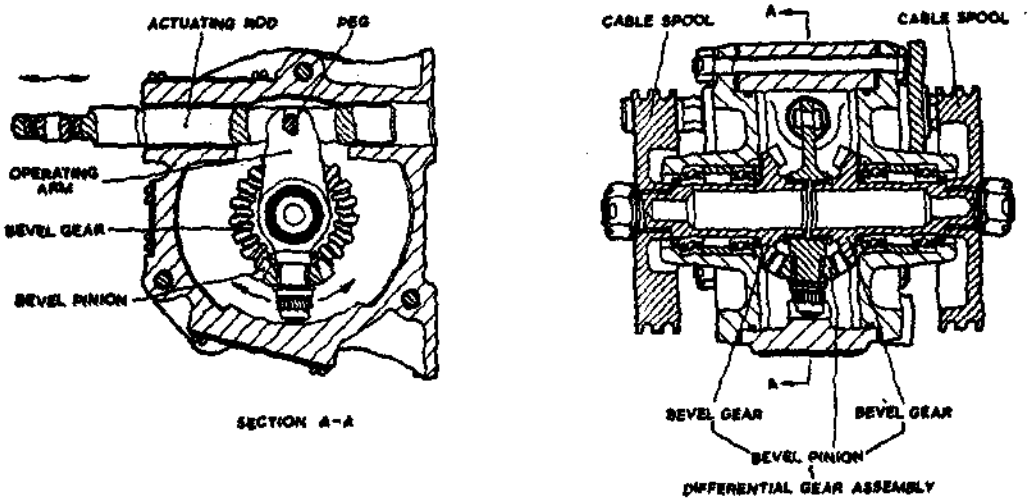
## 3. Data

| | |
|---|---|
| Spool diameter (pitch circle) | 2.8 in. |
| Groove diameter | 0.12 in. |
| Weight | 2.75 lb. |

Figs. 1 to 4 overleaf



Position receiver Type 617, Mk.1
Fig.1



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Mk.1 Functional diagram
Fig.2

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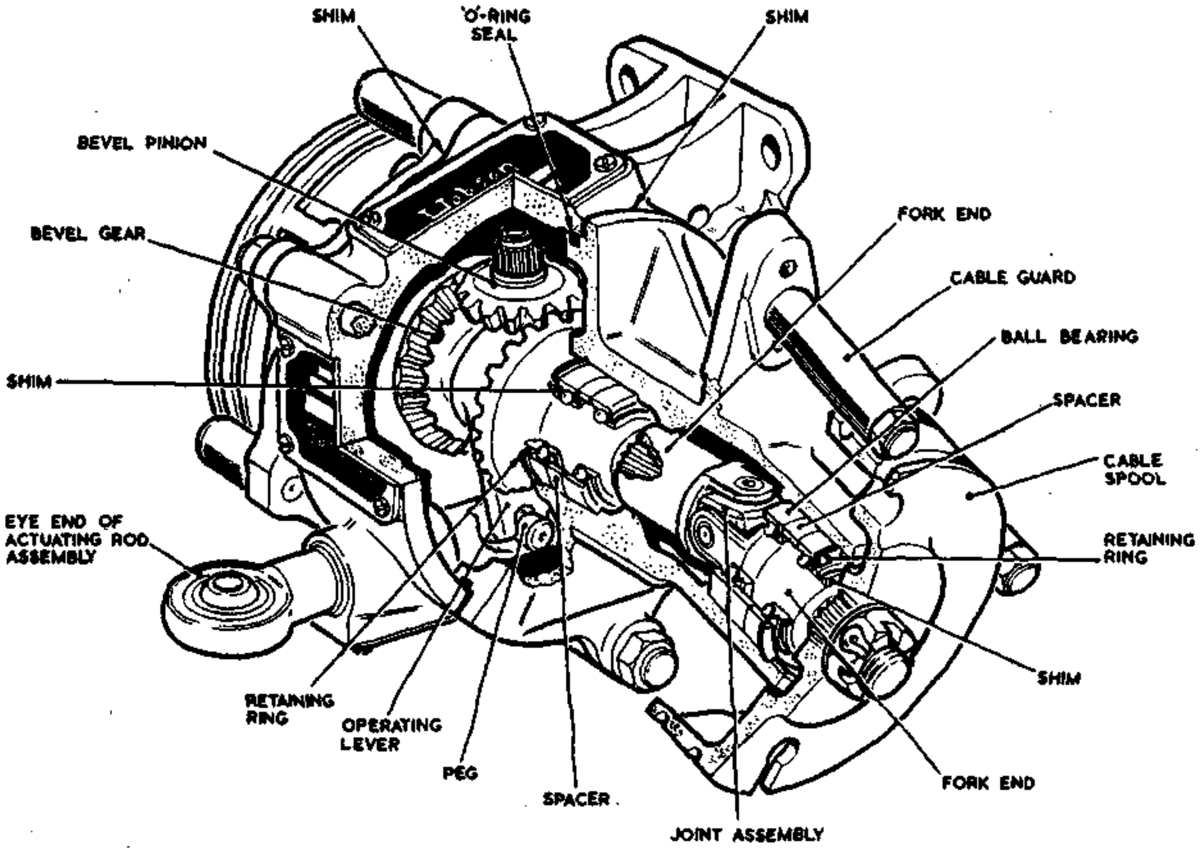
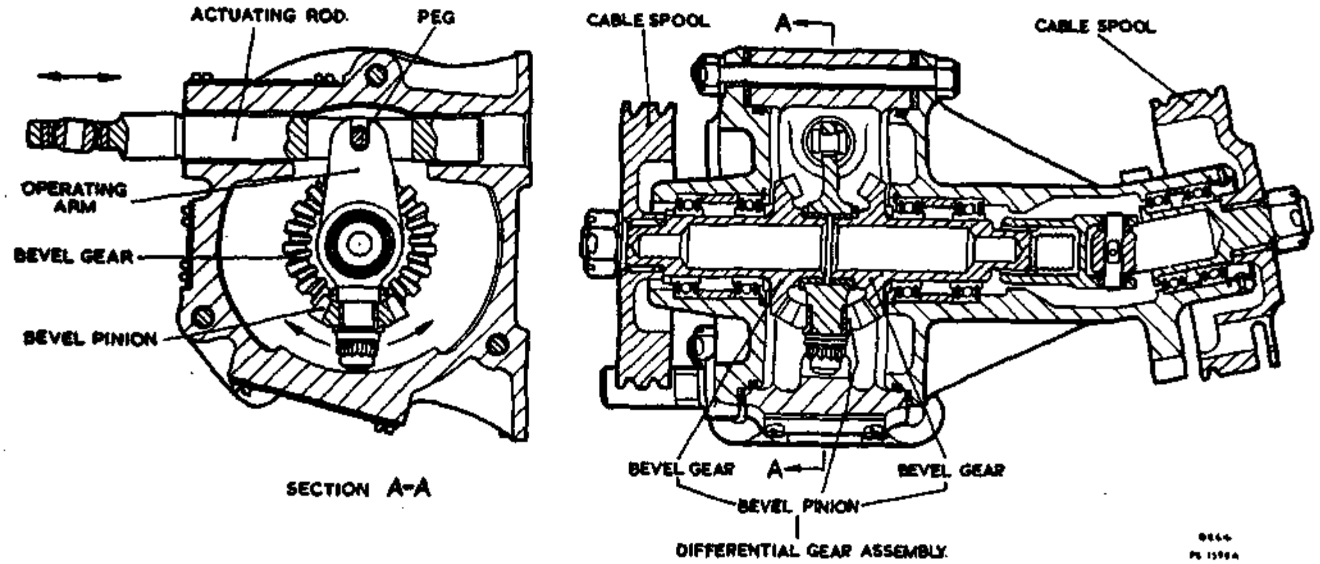


Position receiver Type 716, Mk.4
Fig.3



Mk.4 Functional diagram
Fig.4

* * *

## RECEIVER UNIT - MAINTENANCE PRACTICES

### 1. Unit servicing

For routine lubrication refer to the Maintenance Schedule.

### 2. Removal/Installation

#### A. Remove receiver unit

(1) Pressurize hydraulic system (see Chapter 29, MAIN SYSTEM) and select flaps UP. When flap movement ceases release system pressure.

(2) Remove upper access panel from aft wall of left-hand wheel well wall.

(3) Disconnect the receiver unit output plunger from the flap control unit interconnecting rod.

(4) Remove cable guards from receiver unit.

(5) Slacken turnbuckles on cables in the left and right wings and remove cable ends from receiver unit spools.

(6) Remove bolts securing receiver unit to its mounting (and attachment stay - Mod 251903) and remove receiver unit.

#### B. Checks/Tests before installation

(1) Examine unit exterior for evidence of damage and lubricant leakage.

(2) Manually rotate spools and check gears and actuator rod for smoothness of operation.

#### C. Install receiver unit

(1) Position receiver unit on its mounting and align attachment bolt holes. Fit bolts, tighten and wire-lock bolt heads together. Mod 251903 : Fit and secure attachment stay.

(2) Wind cables correctly on the receiver unit spools and fit cable ends in the spool slots (see Chapter 27, FLAP CONTROL SYSTEM for cable runs). Fit and secure cable guards.

(3) Rig the synchronizing control system (see Chapter 27, FLAP CONTROL SYSTEM).

(4) Functionally test flaps control system (see Chapter 27, FLAP CONTROL SYSTEM).

(5) Fit and secure access panel in wheel well wall.

* * *

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## SYNCHRONIZER TRANSMITTER GEAR BOX - MAINTENANCE PRACTICES

### 1. Unit servicing

For routine lubrication refer to the Maintenance Schedule.

### 2. Removal/Installation

#### A. Remove transmitter gear box

(1) Pressurize hydraulic system (see Chapter 29, MAIN SYSTEM) and select flaps LND (land). When flap movement ceases, release system pressure.

(2) Mod.252155 : remove transmitter shield and cable guard.

(3) Disconnect cranked link from gear box operating lever.

(4) Left only : disconnect adjustable link from Desynn transmitter operating lever.

CAUTION : DO NOT ALLOW TRANSMITTER TO FLICK BACK ON TO ITS STOP.

(5) Slacken control cables serving the appropriate transmitter gear box at the turnbuckles in the wheel bay.

(6) Remove cable guards from body of gear box and remove cable ends from gear box spools.

(7) Remove bolts securing transmitter gear box to its mounting bracket and remove gear box.

#### B. Install transmitter gear box

(1) Position transmitter gear box on its mounting bracket, fit securing bolts and tighten.

(2) Wind cables correctly on the gear box spools and fit cable ends in the spool slots (see Chapter 27, FLAP CONTROL SYSTEM for cable runs). Fit and secure cable guards.

(3) Left only : connect adjustable link from gear box, to operating arm on Desynn transmitter. Grease shear pin liberally with low temperature grease DTD. 844, 866 or 5598 and secure link and operating lever together by fitting shear pin and collar; lock with split pin.

(4) Connect cranked link (from flap) to operating arm on transmitter gear box. Liberally grease bearings and housing, and attachment bolt, prior to assembly with low temperature grease DTD.844, 866 or 5598. Rotate bearing ball joint to ensure penetration of grease. Secure cranked link and operating arm together by fitting bolt and slotted nut. Tighten nut and lock with split pin.

(5) Rig synchronizing mechanism (see Chapter 27, FLAP CONTROL SYSTEM).

(6) Mod.252155 : refit transmitter shield and cable guard.

(7) Functionally test flap control system (see Chapter 27, FLAP CONTROL SYSTEM).

* * *

## AIRBRAKE AND LIFT DUMP CONTROL SYSTEM - DESCRIPTION AND OPERATION

### 1. Description (Fig.1)

### A. General

Upper and lower airbrake surfaces are fitted aft of the rear spar on each wing. When shut, the surfaces form part of the flap shroud.

Each pair of airbrakes (upper and lower) is operated by a hydraulic jack with an integral selector valve. An airbrake selector lever and cable drum on the control pedestal are connected to the two selector valves by cables and bell-cranks. The bell-cranks are interconnected by a balance cable to synchronize movement of left and right airbrakes.

An adjustable, spring-loaded friction damper acts on the cable drum.

A microswitch, mounted at each airbrake inboard hinge bracket on the airbrake stop bracket, is operated when the airbrakes are closed. The switches are connected to a magnetic indicator in the flight compartment.

The microswitches at the airbrake inboard hinge and the right-hand main landing gear leg down lock and the door-up lock microswitches (see Chapter 32, LANDING GEAR) are in circuit with series-connected throttle operated microswitches. When both throttles are operated beyond the 40%-60% rev/min position with the landing gear locked down and the airbrakes open, a horn gives audible warning.

The flaps can be lowered to a lift dump position by a selection of the airbrake selector control lever when the flaps are in the 45° (landing) position.

The airbrake balance cable carries an adjustable bobbin which is associated with the baulk lever on the flap control unit (Fig.1).

### B. Operating jacks

The body of each hydraulic jack has trunnions which pivot in bushes in the inboard hinge bracket of the upper airbrakes. The eye end of the piston rod is attached to the wing structure. The selector valve is bolted to the side of the jack and carries the hydraulic supply and return lines. The selector valve plunger is controlled by a lever pivoted on the jack body, and is biased to the shut position by springs in the valve body.

### 2. Operation (Fig.1)

### A. Airbrake selection

Movement of the airbrake selector lever rotates the cable drum. From the drum, control cables pass, through the fuselage, to bell-cranks on the wing rear spar.

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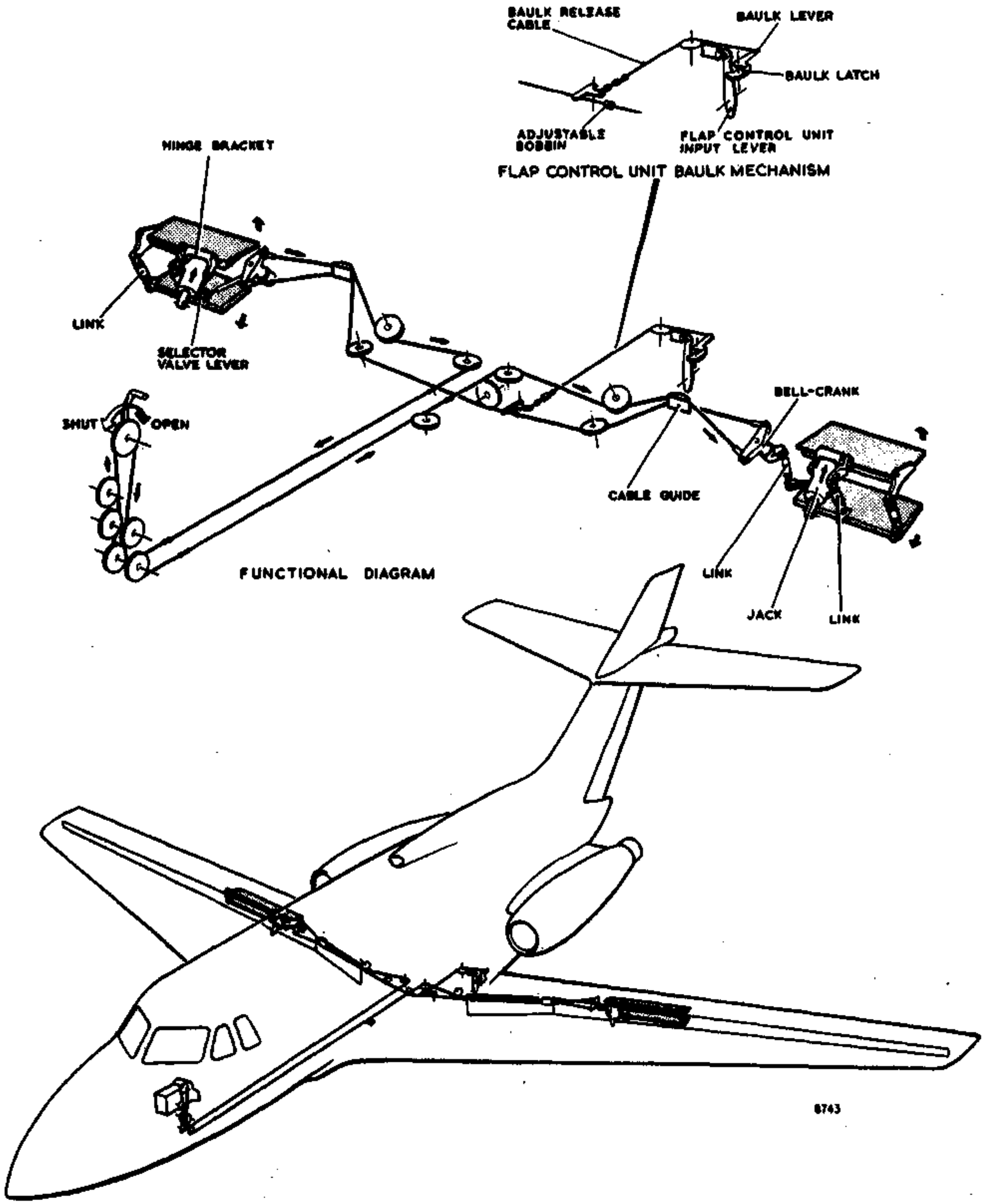

Airbrake control system
Fig.1

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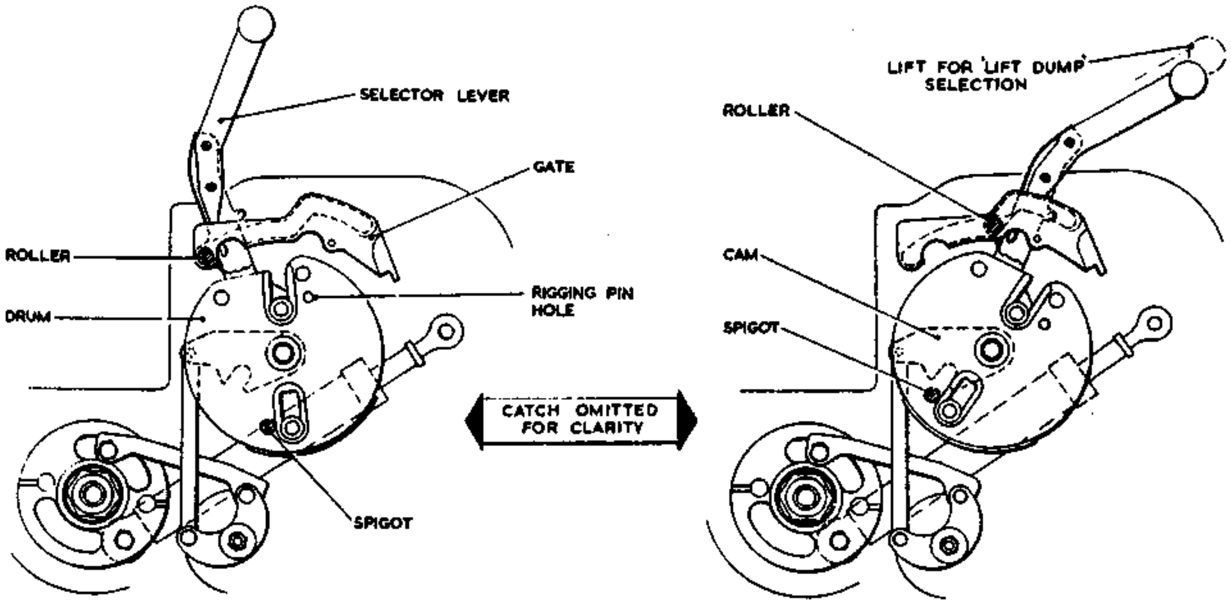
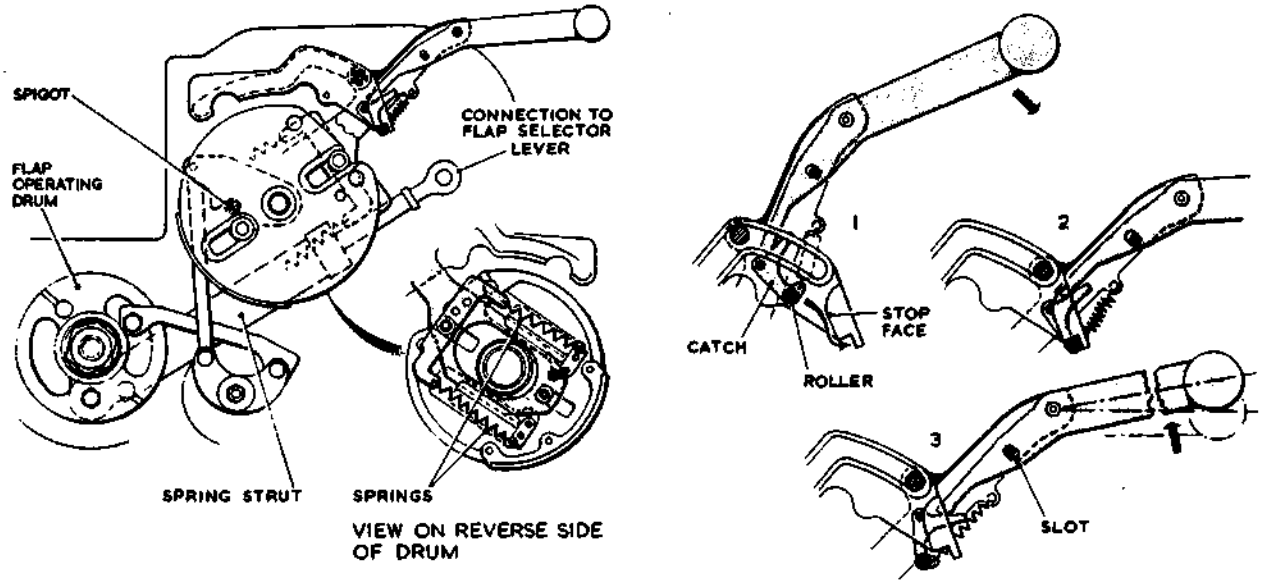


**AIR BRAKES SHUT**

LEVER IS MOVED FORWARD, ROTATING DRUM. ROLLER MOVES TO FORWARD END OF GATE TRACK.

**AIR BRAKES OPEN**

LEVER IS MOVED TO REAR, ROTATING DRUM. ROLLER MOVES TO MID POSITION OF GATE TRACK. SPIGOT MOVES TO POSITION OPPOSITE CAM SLOT. (CAM IS ONLY IN THIS POSITION WHEN FLAPS ARE SELECTED TO LAND)



**LIFT DUMP SELECTED**

LEVER IS LIFTED AGAINST THE SPRINGS AND MOVED TO REAR. ROLLER RIDES UP AND MOVES TO REAR END OF GATE TRACK. SPIGOT ENGAGES IN CAM SLOT, ROTATES CAM AND FLAP OPERATING DRUM AGAINST THE TENSION OF THE SPRING STRUT.

**CATCH OPERATION**

1 DURING FINAL STAGE OF 'LIFT DUMP' SELECTION CATCH ROLLER RIDES ROUND STOP FACE.

2 AT FINAL 'LIFT DUMP' SELECTION CATCH ROLLER ENGAGES BEHIND STOP.

3 ON INITIAL MOVEMENT AWAY FROM 'LIFT DUMP' UPPER PART OF LEVER MOVES RELATIVE TO LOWER (WITHIN LIMITS OF SLOT) DISENGAGING CATCH FROM STOP. LEVER IS NOW FREE TO MOVE FORWARD.

2663/2

Airbrake and lift dump selection
Fig.2

...Airbrake control system - Description and operation continued

From each bell-crank, a link transmits movement in the selector valve lever. Subsequent movement of the jack bodies acts on the inboard hinge bracket of the upper airbrakes, and opens the airbrakes. Links connected between the hinge brackets of upper and lower airbrakes ensure that upper and lower airbrakes move simultaneously.

As the airbrakes open, the microswitches are operated causing the magnetic indicator to show OPEN. When the airbrakes are selected shut the indicator reverts to SHUT; a cross-hatching is displayed when no power supplies are being fed to the indicating circuit.

When the landing gear is locked down, main gear doors locked up, and the airbrakes are not completely shut, operation of both throttles beyond the 40%-60% rev/min. position will complete a circuit and cause the warning horn to sound.

The airbrakes can be stopped at any intermediate setting between OPEN and SHUT by making the appropriate selection on the control lever. Since the jack body also moves the selector body, the selector valve will be brought to the neutral position when the selected position has been reached thus arresting airbrake movement.

Movement of the flaps to 'dump' is achieved when the bobbin, on the airbrakes balance cable, moves the bell-crank lever and baulk cable in response to airbrake lever DUMP selection (see Fig.1). This action releases the baulk latch on the flap control unit and permits the unit input lever to make a hydraulic selection of the flaps to the 'dump' angle.

B. Lift dump selection (Fig.2)

With the flaps set to the 45$^{o}$ (landing) position a further flap setting (lift dump) is obtained by moving the airbrake selector lever to the OPEN position and then lifting the lever and moving it to the DUMP position. The sequence of operations for this function is shown on Fig.2.

* * *

# AIRBRAKE AND LIFT DUMPER CONTROL SYSTEM - ADJUSTMENT/TEST

**WARNING: IF A PART OF THIS SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, A FULL EXAMINATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT THERE IS NO DISTORTION, TOOLS, RAGS, OTHER LOOSE OBJECTS OR UNWANTED MATERIAL THAT COULD PREVENT THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE WORK AREA ARE CLEAN.**

**WARNING: IF A PART OF EITHER THE MAIN OR ANY OTHER ASSOCIATED SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, THAT PART OF THE SYSTEM WHICH HAS BEEN CHANGED SHALL BE GIVEN AN ADDED INSPECTION FOR CORRECT INSTALLATION OF LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

**WARNING: WHEN WORKING ON THE FLIGHT CONTROL SYSTEMS, DISPLAY WARNING NOTICES IN THE FLIGHT COMPARTMENT TO PREVENT OPERATION OF THE CONTROLS.**

**WARNING: MAKE SURE THAT THE FLYING CONTROL SURFACE RANGE OF TRAVEL IS CLEAR OF ANY OBSTRUCTIONS.**

*NOTE: For routine lubrication data refer to the Maintenance Schedule.*

## 1. Rig airbrake control system *(Figure 501)*

### A. Airbrake control system - selector lever to bell-crank

**CAUTION: THE LINKS AND STRUCTURE WILL BE DAMAGED IF THE AIRBRAKES ARE OPERATED MORE THAN THE SPECIFIED OPEN POSITION. WHEN THE CONTROL SYSTEM IS DISCONNECTED, MAKE SURE THAT BOTH SELECTOR VALVES ARE SET TO CLOSE THE JACKS BEFORE PRESSURIZING SYSTEM.**

**CAUTION: DO NOT USE A HYDRAULIC TEST RIG WHILE THE CONTROL SYSTEM IS DISCONNECTED.**

| Equipment/Materials | Part/Item No. |
|---|---|
| Rigging Pin Set | 25Y493AB |
| Hydraulic Test rig | Local supply |
| Tensiometer | Teleflex T5/2002/401/00 |

(1) Make sure that with the hydraulic system pressurized the flaps up position is correct (FLAP CONTROL SYSTEM).

(2) Set and operate flaps to LND and airbrakes OPEN.

(3) Release hydraulic pressure (Chapter 29, MAIN SYSTEM).

(4) Disconnect the link from the selector valve lever of left and right airbrake jacks.

NOTE: *If the bolt which holds the link to the bell-crank is to be installed (with flaps 0° and airbrakes OPEN), make sure that there is a clearance between the flap vane and bolt. To get clearance, the tail of the bolt may be cropped to leave a minimum of two threads clear of the nut.*

(5) Set the airbrakes selector lever to SHUT.

(6) Install a rigging pin through rigging hole in the control pedestal frame right side panel, through rigging holes in the throttle lever drums and airbrake selector lever drum, into the hole in the rigging plate on the control pedestal frame left side panel.

NOTE: *At each wing rear spar do paragraph (7) to Paragraph 1.B.(2) inclusive.*

(7) Insert a rigging pin through rigging pin holes in the bell-crank and its mounting.

(8) Set tensiometer for 10 cwt cables; position tensiometer in the middle between ribs 3 and 4, on cables from the airbrake selector lever drum to the left and right bell-cranks and balance cable between bell-cranks. Adjust the turnbuckles connecting cable ends 25B-25B, 25C-25C, 26B-26B, 26C-26C and 27B-27B to get a tension of 35-40 lb; make sure that all turnbuckles are in safety, tighten locknuts and lockwire.

### B. Airbrake control system outboard of bell-crank

(1) Make sure that the selector valve on jack is in the airbrake shut position by pressing the link manually. Use airplane ground servicing pump to pressurize hydraulic system and shut the airbrakes. Make sure that airbrakes are to profile at the inboard and outboard trailing edge, and that there is no clearance at the inboard or outboard stops. If necessary, adjust stops for upper airbrakes, or links for lower airbrakes, (AIRBRAKES). Do not lock the airbrake stops and links until the airbrake position has been examined with the hydraulic system pressurized (paragraph (6)).

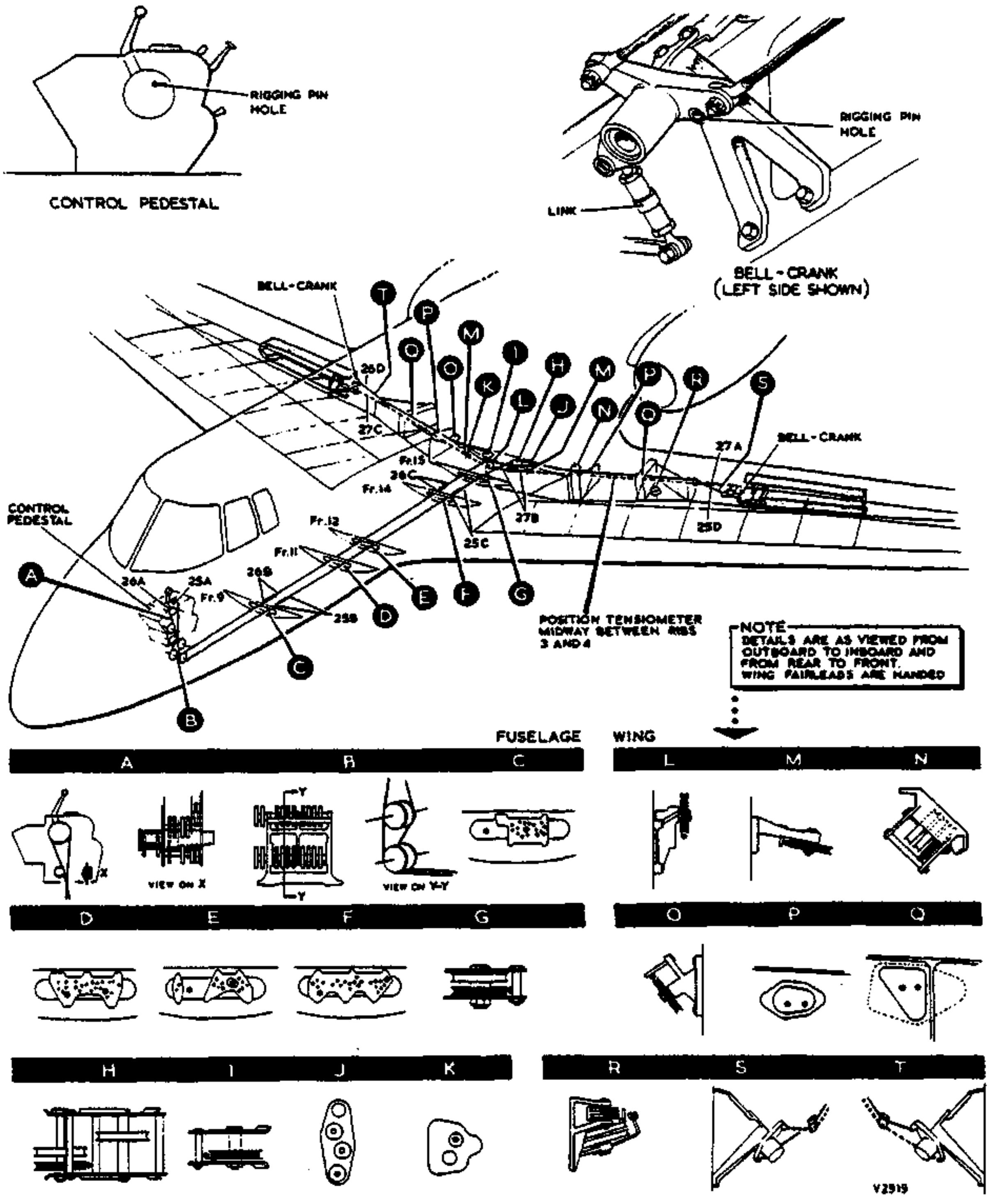
NOTE: *Because the built-in twist of the airbrakes they could lift at the inboard end, if the jack is moved from the shut position. To prevent this, maintain system pressure and continue to operate jack to* the *shut position while you examine profile and stops. Also, maintain the shut position while you adjust link for connection to bell-crank.*

(2) Adjust the link to make connection with bell-crank, make sure that link ends are in safety, tighten locknuts and lockwire. Make sure that flanged bush is fitted in fork-end of bell-crank, with flange outside fork-end. Tighten the link to the bell-crank with retained bolt and slotted nut; lock with cotter pin.

(3) Remove rigging pins from the airbrake selector lever drum in control pedestal, and the bell-cranks on wing rear spar.

NOTE: *It may be necessary to pressurize the system to remove rigging pin from bell-crank.*

(4) Use a test rig to pressurize the system, slowly select airbrakes to open, and do a check for freedom of movement.



Airbrake control system rigging
*Figure 501*

**CAUTION: MAKE THE AIRBRAKE SELECTION SLOWLY. IMMEDIATELY STOP SELECTION IF THE AIRBRAKE CATCHES THE FLAP.**

(5) Select the flap lever to UP and then set the airbrake lever to SHUT.

(6) Make sure that there is clearance between the upper airbrake and flap at airbrake shut position. If necessary, adjust the inboard and outboard stops. For details of upper airbrake shut position and stop adjustment refer (AIRBRAKES). If applicable lock airbrake stops.

(7) Release hydraulic pressure (Chapter 29, MAIN SYSTEM).

(8) Use the airplane ground servicing pump to pressurize the system, set airbrakes to SHUT and make sure that the airbrake position indicator shows SHUT. If necessary, adjust the position of microswitch(es) on stop bracket serrations (at airbrake inboard hinges) by loosening stiffnuts and bolts. After adjustment, tighten microswitch with bolts and stiffnuts. Use a feeler gauge to make sure that at least 0.005 in. overtravel remains on the microswitch after operation.

(9) With landing gear locked down, main gear doors locked up, and the airbrakes open, operate each throttle lever from between 40% - 60% to 100% rpm position, and make sure that the warning horn sounds continuously. If necessary, adjust throttle microswitch(es) (Chapter 32, ELECTRICAL INDICATING SYSTEM).

(10) Rig the selector valve baulk mechanism (FLAP CONTROL SYSTEM).

(11) Examine the airbrake range of movement, (Paragraph 3.B).

(12) Functionally test the airbrake and lift dump control system, (Paragraph 2).

## 2. Do a functional test of airbrake and lift dumper control system

### A. Procedure

(1) Pressurize the hydraulic system from a test rig or by running an engine (Chapter 29, MAIN SYSTEM) and (Chapter 71, GENERAL), and energize d.c. busbars.

*NOTE: If a functional test is to be done after a malfunction of the hydraulic system, open and close the airbrakes a minimum of six times to release all remaining air from the system.*

(2) Operate the airbrakes between shut and open, and do a check of the operation times (Chapter 29, MAIN SYSTEM). Also, make sure that movement of left and right airbrakes is synchronized.

(3) Make sure the airbrake position indicator shows SHUT when the airbrake selector lever is at SHUT, and OPEN when airbrakes leave shut position.

(4) With landing gear locked down, main gear doors locked up, and airbrakes open, operate both throttle levers from between 40%-60% to 100% $N_1$ rpm and make sure that the warning horn sounds continuously while the throttles are at any position above 40% - 60% $N_1$ rpm.

(5) Select flaps to LND position; select airbrakes to OPEN, lift the airbrake selector lever and select DUMP position. Make sure the airbrake position indicator shows OPEN when airbrakes move from the shut position. Make sure the flap position indicator shows DUMP, and that airbrake selector lever is held in the DUMP position.

(6) Set the airbrakes to SHUT. Make sure the flap position indicator shows LAND, and that airbrakes position indicator shows SHUT.

(7) Set intermediate positions on the airbrake selector lever. Make sure the left and right airbrake positions are almost the same.

(8) Set the airbrakes to SHUT and flaps UP. De-energize the d.c. busbars (Chapter 24, GENERAL). Make sure the airbrake position indicator shows cross-hatching, and the flap position indicator is off scale.

(9) Disconnect the hydraulic test rig or stop engine, as appropriate (Chapter 29, MAIN SYSTEM).

## 3. Rigging and Range of Movement checks

### A. Examine rigging of airbrake control system and lift dump mechanism

(1) Use a test rig to pressurize the hydraulic system (Chapter 29, MAIN SYSTEM).

(2) Set the airbrakes to SHUT and flaps to LND.

(3) Install a rigging pin through rigging hole in the control pedestal frame right side, through rigging holes in throttle control lever drum and airbrake drum, into hole in rigging plate on control pedestal left side panel.

(4) Install a rigging pin through rigging holes in the bell-crank and its mounting.

(5) Set the tensiometer to apply to 10 cwt cables, and position tensiometer on airbrake cables midway between ribs 3 and 4. Make sure the tension of cables from the airbrake selector lever drum to left and right bell-cranks and balance cable between the bell-cranks is 35-40 lb.

(6) Make sure there is no clearance at the inboard and outboard stops of the left and right upper airbrake.

**CAUTION: STOP SELECTION IF FLAPS TEND TO CATCH AIRBRAKES.**

(7) Set the flaps to UP.

(8) Make sure the upper airbrake is at the shut position (Chapter 27, AIRBRAKES) and that lower airbrake trailing edge is to profile.

(9) Remove rigging pins from the airbrake drum in control pedestal, and bellcranks on wing rear spar.

(10) With the airbrake selector lever at SHUT, make sure the airbrake position indicator shows SHUT.

(11) With landing gear locked down, select the airbrakes OPEN, operate both throttle levers from between 40% - 60% to 100% $N_1$ rpm, and make sure the warning horn sounds continuously while the throttles are at any position above 40% - 60% $N_1$ rpm.

(12) Select the flaps to LND. Lift the airbrake selector lever and select DUMP position, make sure the flap position indicator shows DUMP.

(13) Set the airbrakes to SHUT. Make sure the flap position indicator shows LAND, and that airbrakes position indicator shows SHUT. Select flaps to UP.

(14) Release the pressure in the hydraulic system (Chapter 29, MAIN SYSTEM).

### B. Examine airbrake range of movement

*NOTE: Make sure the throttles are below the 40% $N_1$ rpm position.*

(1) Use the airplane ground servicing pump to pressurize the hydraulic system, set the flaps to LND and the airbrakes to SHUT. Make sure there is no clearance at the inboard or outboard stops of the upper airbrakes, and that lower airbrakes are to profile.

(2) Record inclinometer indications in line of flight, aft of inboard hinge of upper and lower airbrakes.

(3) Set airbrakes to OPEN and DUMP, in turn, and make sure, from the inclinometer indications, that the range of movement is as follows:

| | Normal | Dump |
|---|---|---|
| Upper airbrake | 28° ±1° 30' | 47° ±4° |
| Lower airbrake | 54° ±1° 30' | 70° ±5° |

(4) Set the airbrakes to SHUT.

## AIRBRAKE - MAINTENANCE PRACTICES

WARNING : SECURE WARNING LABEL TO AIRBRAKE SELECTOR LEVER BEFORE WORKING ON OR NEAR AIRBRAKES WHILE HYDRAULIC SYSTEM IS PRESSURIZED.

### 1. Unit servicing

#### A. Lubrication

For routine lubrication data refer to the Maintenance Schedule.

### 2. Removal/Installation (Fig.201)

Materials required :

| | | | |
|---|---|---|---|
| Grease, low temperature | .. | .. | DTD 844, 866 or 5598 |
| Grease, MX-33 | .. | .. | DTD 900/4630 |
| Compound, Jointing JC5A | .. | .. | DTD 900/4488 |
| Thiokol, PR1422 | .. | .. | DTD 900/4868 |

#### A. Remove upper airbrake

(1) Use aircraft ground servicing pump to pressurize system, and select flaps to LND and airbrakes to OPEN.

(2) Release hydraulic pressure (see Chapter 29, GENERAL).

(3) Disconnect links, between upper and lower airbrakes, at upper airbrake.

(4) Remove forward fairing at inboard hinge, and both fairings at outboard hinge.

(5) Make provision to collect residual fluid, disconnect hoses from jack; blank off all open connections.

(6) Disconnect selector valve lever from link, jack eye end from pivot on rear spar, and bonding wire (if applicable).

(7) Support airbrake. Remove inboard hinge bolt, remove Thiokol fillet and partially withdraw outboard hinge bolt sufficiently to remove airbrake complete with jack.

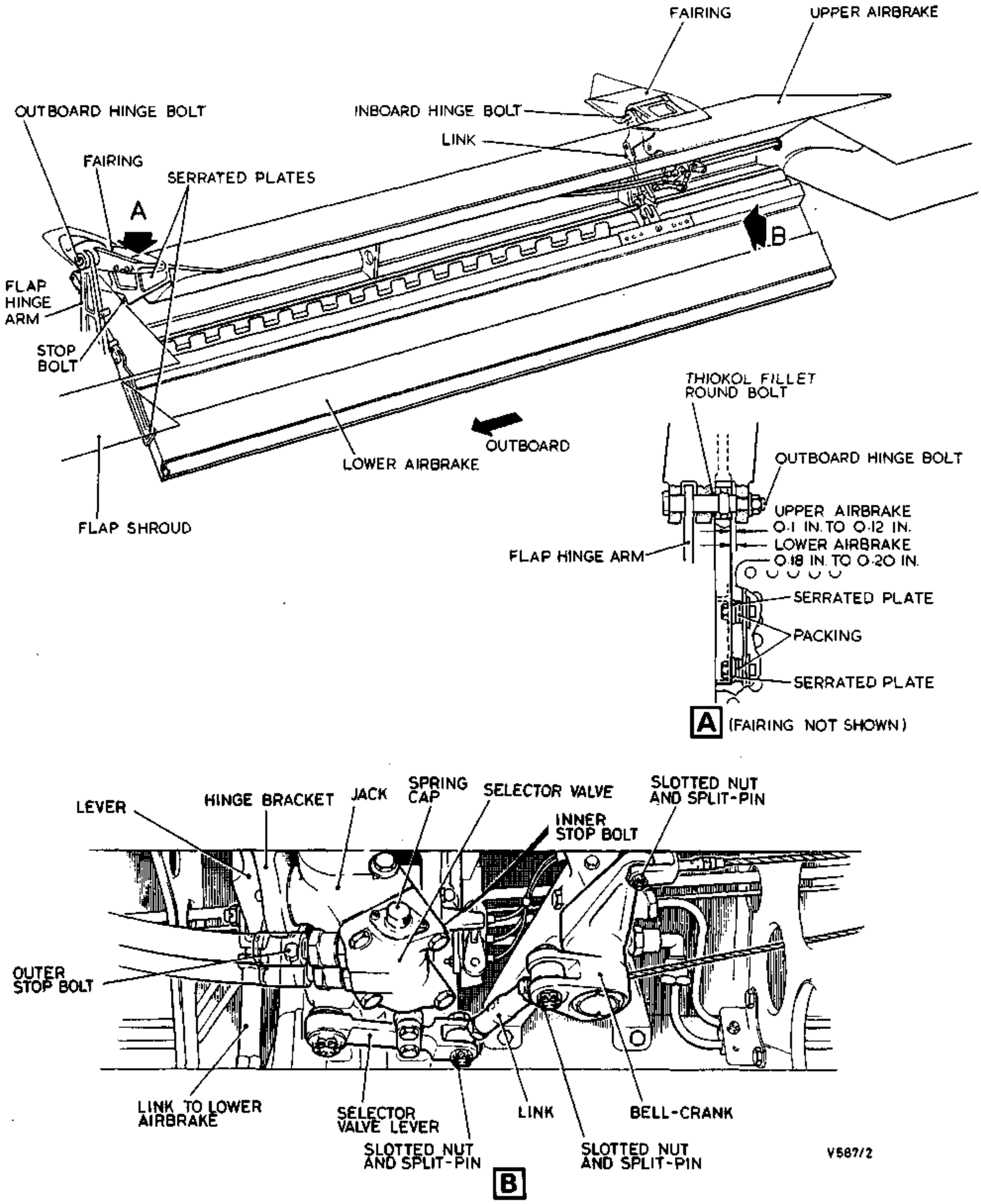
CAUTION : DO NOT REMOVE OUTBOARD HINGE BOLT COMPLETELY AS FLAP SUPPORT IS MOUNTED ON THE SAME BOLT.

#### B. Install upper airbrake

NOTE : (1) Before assembly, treat shanks of studs and bolts with MX-33 grease, contacting faces of bolt heads, washers and nuts with jointing compound.
(2) The slotted stiffnuts fitted to the selector valve link and bellcrank must be replaced on removal by new Type F12N stiffnuts.

(1) Lubricate trunnions of airbrake jack with low temperature grease. Fit outboard trunnion into bush in upper airbrake hinge bracket. Position side plate on inboard trunnion, and secure to hinge bracket with washers and nuts; lock nuts with split pins.

(2) Locate upper airbrake in hinge brackets on wing; fit and secure hinge bolts with washers and nuts and lock nuts with split pins. Connect bonding wire (if applicable). Apply a fillet of Thiokol round outboard hinge bolt where shown on Fig.201.



Airbrake installation
Fig.201

...Airbrakes - Maintenance practices continued

(3) At outboard hinge, check clearance between hinge bracket and inboard lug of wing fitting. If necessary, adjust packing to obtain clearance (see Fig.201).

(4) Fit and secure forward fairing at inboard hinge and both fairings at outboard hinge.

(5) Secure jack eye end to pivot on rear spar with bolt, washer and nut; lock nut with split pin.

(6) Remove blanks and fit hoses to jack connections. Tighten unions and wire-lock.

(7) At inboard hinge outer stop, set airbrake trailing edge to profile by adjusting washers under stop bolt head. Tighten stop bolt and wire-lock to adjacent tag.

(7A) At inboard hinge inner stop :-
Pre mod. 252133 : Fit a new tab washer under the locknut of the stop bolt, adjust stop bolt so that both stops at inboard hinge contact simultaneously. Tighten locknut and lock with tab washer.

Mod. 252133 : Adjust washers under head of stop bolt so that both stops at inboard hinge contact simultaneously. Wire-lock stop bolt to stop fitting.

NOTE : To facilitate adjustment of stops adjacent to airbrake jack, the stop at the outboard hinge may be temporarily removed.

(8) Secure inboard link to lever on upper hinge bracket with bolt, washer and nut; position nut on outboard side of link, and lock nut with split pin. If necessary, adjust link to bring lower airbrake trailing edge to profile at inboard end with the upper airbrake on its inboard stops. Check that ends of link are in safety, tighten locknuts and wire-lock. Check that there is a minimum clearance of 0.05 in. (on some earlier aircraft, a minimum clearance of 0.03 in. is permissible) between the head of link upper attachment bolt and the adjacent bracket.

(9) At outboard hinge, set upper airbrake to profile at the hinge point by adjusting on the serrated plates; after adjustment, secure serrated plates with bolts, and wire-lock heads together. Set trailing edge to profile by adjusting washers under head of stop-bolt. Tighten stop-bolt and wire-lock.

NOTE : After adjustment of the outboard stop-bolt there will be a very small clearance at the inboard pair of stops when the outboard stop-bolt is contacted. This clearance will be taken up when the airbrakes are closed by the hydraulic system.

(10) Secure outboard link to upper hinge bracket with bolt, washer and nut; position nut on inboard side of link, and lock nut with split pin. If necessary, adjust link to bring lower airbrake trailing edge to profile at outboard end with upper airbrake on its outboard stop. Check that ends of link are in safety, tighten locknuts and wire-lock.

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...Airbrakes - Maintenance practices continued

(11) Ensure that flanged bush is fitted in fork-end of selector valve lever with flange outside fork-end. Secure link to selector valve lever with bolt and a new slotted stiffnut; lock nut with split pin.

NOTE: With flaps UP and airbrakes OPEN, check that there is a clearance between flap vane and bolt securing link to bell-crank. To obtain clearance, the tail of the bolt may be cropped to leave a minimum of two threads clear of nut.

(12) Using test rig pressurize hydraulic system (Chapter 29 - GENERAL).

(13) Select airbrake lever to a position approximately half-way between OPEN and SHUT, and then select flap lever to UP.

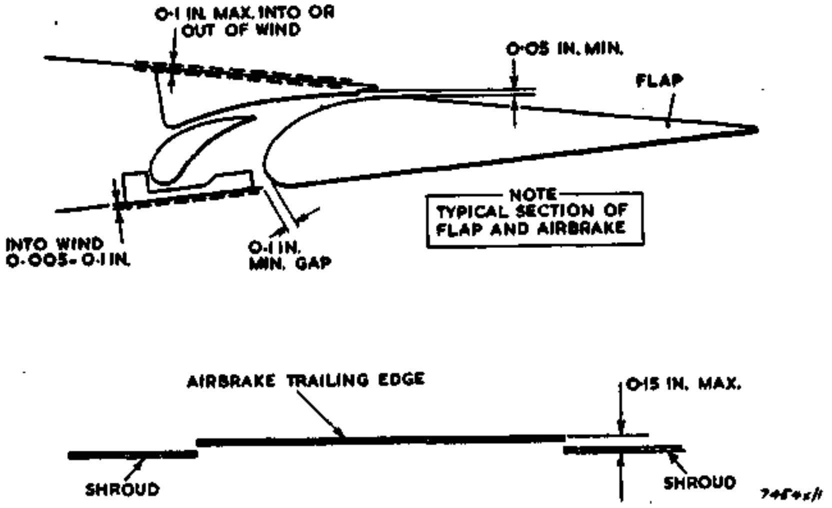
(14) Slowly select airbrake lever to SHUT position.

CAUTION: STOP SELECTION IF AIRBRAKE TENDS TO FOUL FLAP.

(15) Check that upper airbrake is at shut position (Fig.202) and that lower airbrake is to profile. If necessary, make adjustments at the airbrake stops in the following order: adjust stops adjacent to jack to achieve simultaneous contact and then adjust stop at outboard end of airbrake. After adjusting stops, check that when airbrakes are shut the rigging holes in bell-crank and its mounting are aligned. If necessary, adjust link between selector valve lever and bell-crank.

(16) When shut position and rigging hole alignment are achieved simultaneously, check that ends of link are in safety, tighten locknuts and wire-lock; lock three airbrake stops.

(17) If necessary, adjust airbrake microswitch. (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM ).



Airbrake clearances
Fig. 202

...Airbrakes - Maintenance practices continued

(18) Check airbrake range of movement (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM).

(19) Functionally test airbrake control system (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM).

C. Remove lower airbrake

(1) Use aircraft ground servicing pump to pressurize system, and select flaps to LND and airbrakes to OPEN.

(2) Release hydraulic system pressure (see Chapter 29, MAIN SYSTEM).

(3) Disconnect links, between upper and lower airbrakes, at lower airbrake.

NOTE : It will be necessary to shut the airbrakes slightly to remove the outboard link bolt. Operate airbrake using the aircraft ground servicing pump until desired position is reached. Release hydraulic system pressure.

(4) Remove forward fairings at airbrake hinges, and fairing from flap fixed hinge arm at airbrake outer hinge.

(5) Support airbrake, remove inboard hinge bolt and partially withdraw outboard hinge bolt sufficiently to remove airbrake.

CAUTION : DO NOT REMOVE OUTBOARD HINGE BOLT COMPLETELY AS FLAP SUPPORT IS MOUNTED ON SAME BOLT.

D. Install lower airbrake

NOTE : Before assembly, treat bolt shanks with grease DTD 900/4630 and treat contacting faces of bolt heads, washers and nuts with jointing compound JC.5A (DTD 900/4488).

(1) Locate lower airbrake in hinge brackets on wing; fit and secure hinge bolts with washers and nuts, and lock nuts with split pins.

(2) At outboard hinge, check clearance between hinge bracket and inboard lug of wing fitting. If necessary, adjust packing to obtain clearance (see Fig.201).

(3) At outboard hinge, set airbrake to profile at the hinge point by adjusting on the serrated plates; after adjustment, secure serrated plates with bolts and wire-lock heads together.

(4) Fit flap hinge fairing at airbrake outboard hinge, and forward fairings at airbrake hinges, and secure with bolts.

(5) Secure link to outboard, lower hinge bracket with bolt, washer and nut; position nut on inboard side of link, and lock nut with split pin. If necessary, adjust link to bring lower airbrake to profile with upper

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...Airbrakes - Maintenance practices continued

airbrake on its outboard stop. Check that ends of link are in safety, tighten locknuts and wire-lock.

NOTE : It will be necessary to shut airbrakes slightly to insert bolt into outboard link. Operate airbrakes to the required position, using the aircraft ground servicing pump. Release hydraulic pressure.

(6) Secure link to inboard lower hinge bracket with bolt, washer and nut; position nut on outboard side of link, and lock nut with split pin. If necessary, adjust link to bring lower airbrake trailing edge to profile at inboard end, with the upper airbrake on its inboard pair of stops. Check that ends of link are in safety, tighten locknuts and wire-lock. Check that there is a minimum clearance of 0.050 in. between the head of link upper attachment bolt and the adjacent bracket.

NOTE : To obtain contact at the inboard pair of stops, operate airbrakes to the shut position using the aircraft ground servicing pump.

(7) Check airbrake range of movement (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM ).

(8) Functionally test airbrake control system (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM ).

* * *

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## AIRBRAKE JACK - MAINTENANCE PRACTICES

WARNING : RELEASE HYDRAULIC PRESSURE (SEE CHAPTER 29, GENERAL) BEFORE WORKING ON OR NEAR AIRBRAKE SURFACES.

### 1. Unit servicing

#### A. Lubrication

For routine lubrication data refer to the Maintenance Schedule.

### 2. Removal/Installation

Materials required :-

| | |
|---|---|
| Grease, low temperature | ... DTD 844, 866 or 5598 |
| Grease, MX-33 | ... DTD 900/4630 |
| Compound, jointing, JC5A | ... DTD 900/4488 |

#### A. Remove airbrake jack

(1) Operate flaps to LND and airbrakes to OPEN.

(2) Release hydraulic pressure (See Chapter 29, GENERAL).

(3) Make provision to collect residual fluid, disconnect hoses from jack, and blank off all open connections.

(4) Disconnect selector valve lever from link, and disconnect jack eye end from pivot on rear spar.

(5) Remove side plate from inboard hinge bracket and jack inboard trunnion; remove jack. Re-assemble side plate to inboard hinge bracket.

#### B. Install airbrake jack

(1) Lubricate trunnions of jack with low temperature grease. Fit outboard trunnion into bush in upper inboard hinge bracket. Treat bores of plain bushes in sideplate with MX-33 grease. Fit side plate onto inboard trunnion. Treat contact faces of nuts and washers with JC.5A jointing compound; secure side plate to inboard hinge bracket with washers and nuts, and lock nuts with split pins.

(2) Secure jack eye end to pivot on rear spar with bolt, washer and nut; lock nut with split pin.

(3) Remove blanks and fit hoses. Tighten unions and wire-lock.

(4) Lubricate jack, through the three nipples, with low temperature grease.

NOTE : If the bolt securing link to bell-crank is being fitted (with flaps UP and airbrakes OPEN) check that there is a clearance between flap vane and bolt. To obtain clearance, the tail of the bolt may be cropped to leave a minimum of two threads clear of nut.

...Airbrake jack - Maintenance practices continued

(5) Operate airbrake lever to SHUT.

(6) Insert rigging pin through rigging holes in bell-crank and its mounting.

(7) Rig airbrake control system outboard of bell-crank (see Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM) ensuring that, with airbrake fully SHUT, there is a minimum clearance of 0.050 in. between the spring cap on the jack and the aircraft structure.

NOTE : The fittings must NOT be dressed to obtain a clearance.

* * *

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# GUST LOCK - AILERONS, ELEVATORS AND THROTTLE LEVERS BAULK - DESCRIPTION AND OPERATION

## 1. Description

A gust lock is provided which will, when attached to the control column handwheel, prevent aileron and elevator control surface movement and restricts movement of the No.1 and 2 engine throttle levers.

Fitted to the side of the flight compartment adjacent to the first pilot's control column, the gust lock incorporates a pulley which is coupled by cable to a baulk unit at the centre control pedestal.

At the baulk unit, the cable end is anchored to a spring-loaded pulley. The pulley is mounted on a spindle together with a latch lever and roller assembly. In the main, other components of the baulk unit comprise two throttle slave levers and a baulk lever arm. Fitted to the end of the lever arm is the baulk.

Interconnection between the engine throttle levers and the baulk unit slave levers is by adjustable connecting rods.

## 2. Operation

To lock the aileron and elevator control surfaces the gust lock must be removed from its stowage clip and swung round to the control column. With the column correctly positioned the claws on the lock must be located around the handwheel and over the locating bushes. Pushing down, and turning the knurled ring on the lock will close the claws into the handwheel bushes.

When the gust lock is swung from its stowage, the cable anchored to the end of the lock causes the pulley on the baulk unit to turn on its spindle (Fig.1, Detail B).

Pulley and spindle movement lifts the latch lever and the roller rides up the baulk lever arm forcing the lever to bring the baulk into its effective position. The range of No.1 and/or 2 throttle levers are now restricted to the functions shown on Fig.2.

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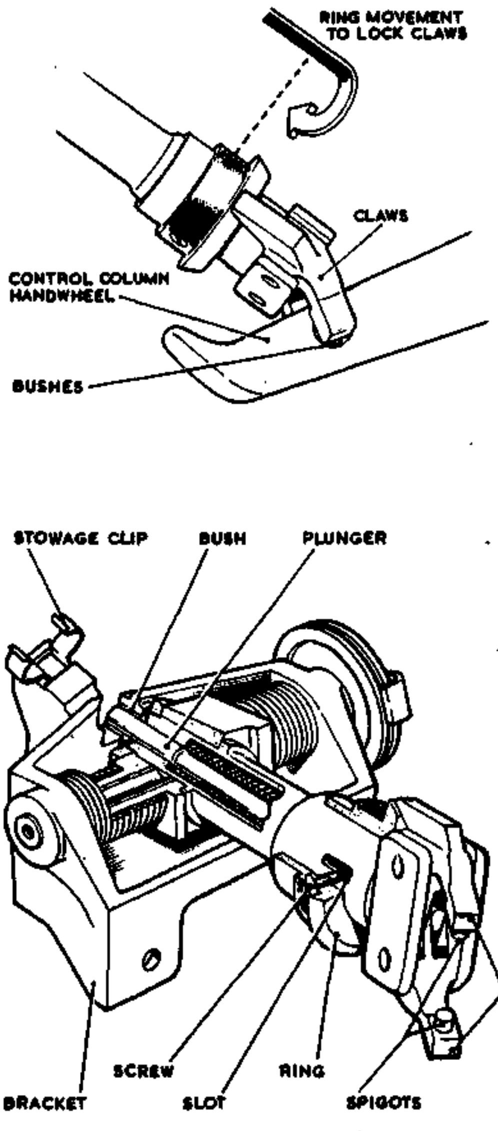
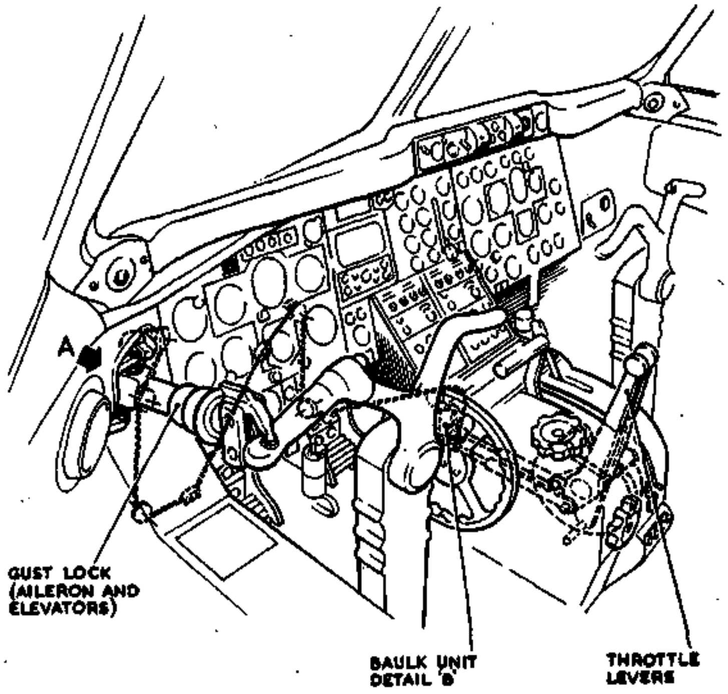
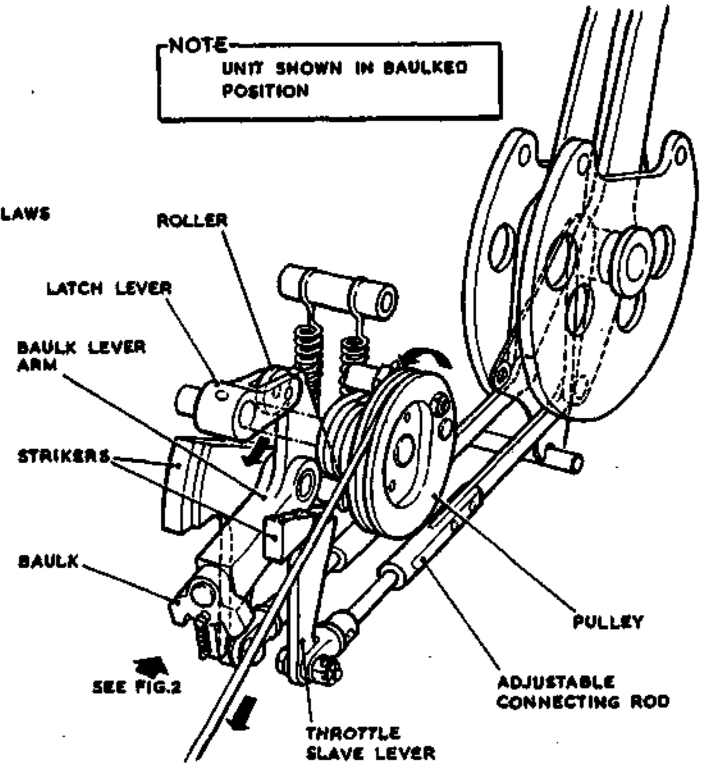


GUST LOCK — DETAIL A





BAULK UNIT OPERATING MECHANISM — DETAIL B

TO FIT GUST LOCK :-

1. RELEASE GUST LOCK FROM STOWAGE CLIP, SWING LOCK ROUND AND, WITH AILERON HANDWHEEL NEUTRAL, POSITION CLAWS ON HANDWHEEL.
2. CLOSE SPIGOTS ON CLAWS INTO HANDWHEEL BUSHES BY PUSHING KNURLED RING DOWN AND TURNING CLOCKWISE. ENSURE PLUNGER ENGAGES BUSH IN MOUNTING BRACKET.
   NOTE:- THROTTLE BAULK IS NOW EFFECTIVE.

TO REMOVE GUST LOCK :-

1. TURN KNURLED RING ANTI-CLOCKWISE TO RELEASE CLAW SPIGOTS FROM HANDWHEEL BUSHES.
2. SWING GUST LOCK BACK AND SECURE IN STOWAGE CLIP.
   NOTE:- THROTTLE BAULK HAS NOW BEEN AUTOMATICALLY REMOVED.

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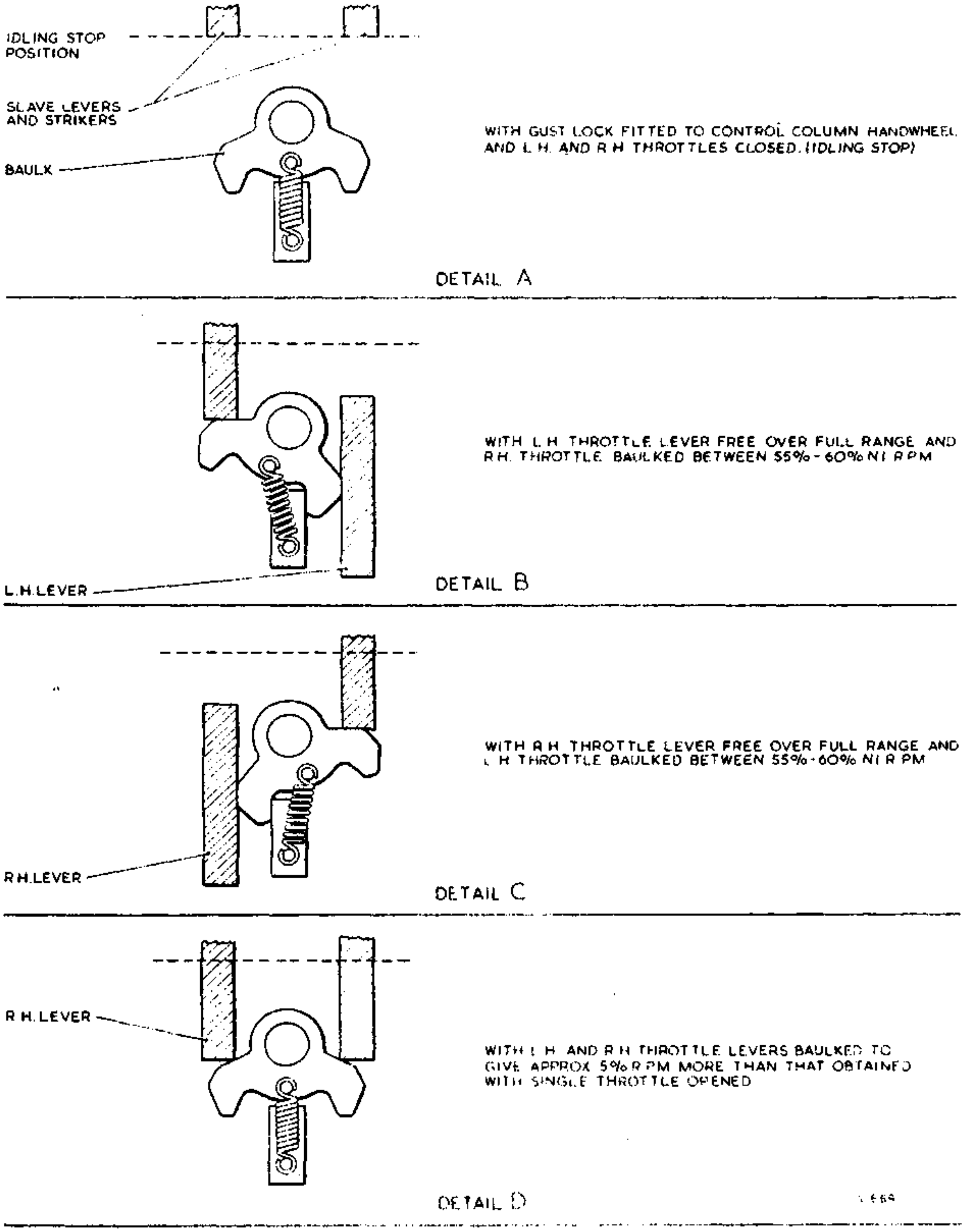
Gust lock and throttle levers baulk
Fig.1



WITH GUST LOCK FITTED TO CONTROL COLUMN HANDWHEEL AND L.H. AND R.H. THROTTLES CLOSED. (IDLING STOP)

WITH L.H. THROTTLE LEVER FREE OVER FULL RANGE AND R.H. THROTTLE BAULKED BETWEEN 55%-60% N1 R.P.M.

WITH R.H. THROTTLE LEVER FREE OVER FULL RANGE AND L.H. THROTTLE BAULKED BETWEEN 55%-60% N1 R.P.M.

WITH L.H. AND R.H. THROTTLE LEVERS BAULKED TO GIVE APPROX. 5% R.P.M. MORE THAN THAT OBTAINED WITH SINGLE THROTTLE OPENED

Throttle levers baulking
Fig.2

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ORIGINAL
As Received By
ATP

...Gust lock - aileron, elevators and throttle levers baulk - Description and operation continued

When the gust lock is removed from the column handwheel, cable and baulk unit levers return under spring loading to their original positions. The latch lever and roller are free of the lever arm which moves down and away from the slave levers. Full and free movement of both throttle levers is now obtainable.

* * *

# GUST LOCK - AILERONS, ELEVATORS AND THROTTLE LEVERS BAULK - ADJUSTMENT/TEST

**WARNING: IF A PART OF THIS SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, A FULL EXAMINATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT THERE IS NO DISTORTION, TOOLS, RAGS, OTHER LOOSE OBJECTS, OR UNWANTED MATERIAL THAT COULD PREVENT THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE AREA ARE CLEAN.**

**WARNING: IF A PART OF THE MAIN OR ASSOCIATED SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, THAT PART OF THE SYSTEM WHICH HAS BEEN CHANGED SHALL BE GIVEN AN ADDED INSPECTION FOR CORRECT INSTALLATION OF LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

**WARNING: WHEN WORKING ON THE FLIGHT CONTROL SYSTEMS, DISPLAY WARNING NOTICES IN THE FLIGHT COMPARTMENT TO PREVENT OPERATION OF THE CONTROLS.**

**WARNING: MAKE SURE THAT THE FLYING CONTROL SURFACE RANGE OF TRAVEL IS CLEAR OF ANY OBSTRUCTIONS.**

*NOTE: For routine lubrication data refer to the Maintenance Schedule.*

## 1. Gust lock

| Equipment/Materials | Part/Item No. |
|---|---|
| Tensiometer | Teleflex T5/2002/401/00 |

### A. Rig gust lock and throttle levers baulk control system *(Figure 501 and Figure 502)*

(1) Install and secure the gust lock to the first pilot's control column handwheel.

(2) Remove the access panel from the left-hand side of the control pedestal, to get access to the baulk unit and throttle levers baulk control cable.

(3) Move the left-hand (LH - No.1 engine) and right-hand (RH - No.2 engine) throttle levers back to the fully 'closed' (engine idling) stops.

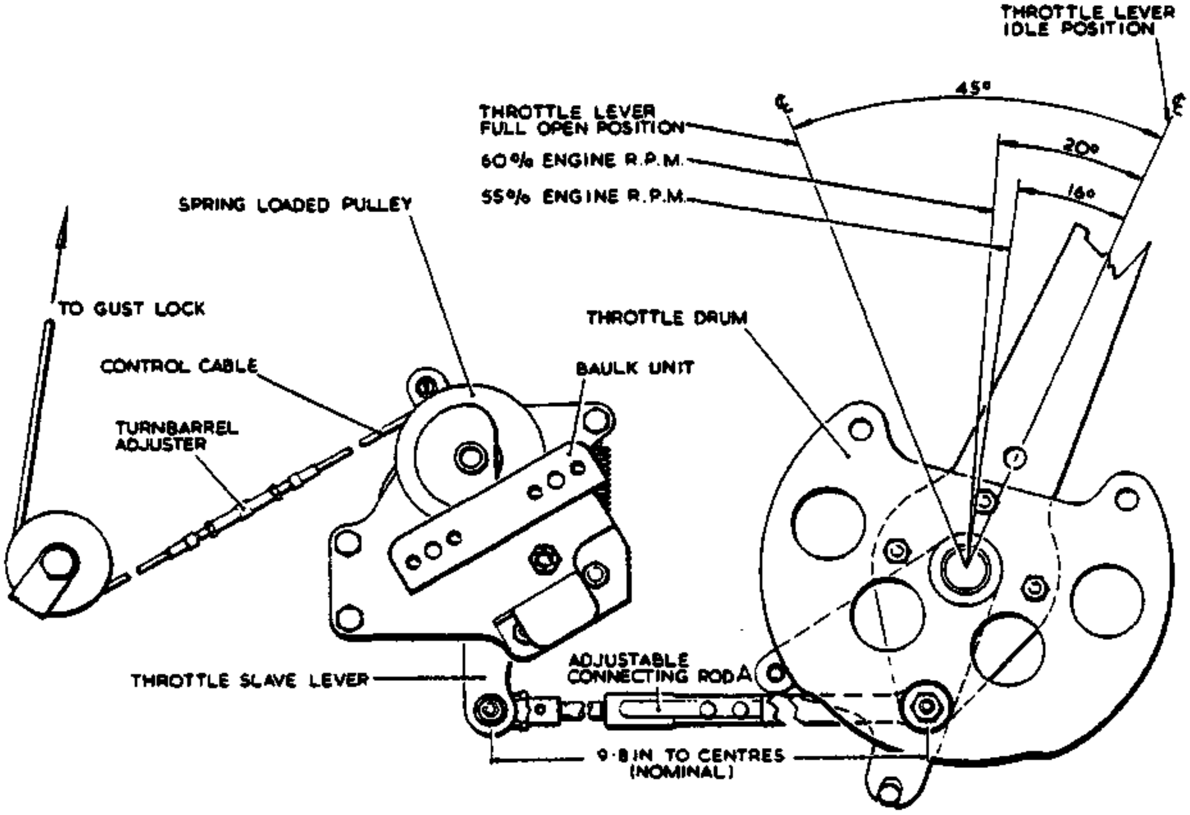
*NOTE: The throttle levers will now be referred to as LH and RH respectively.*

(4) Set tensiometer to apply to 5 cwt cable. Position tensiometer on the vertical section of cable forward of the pedestal.

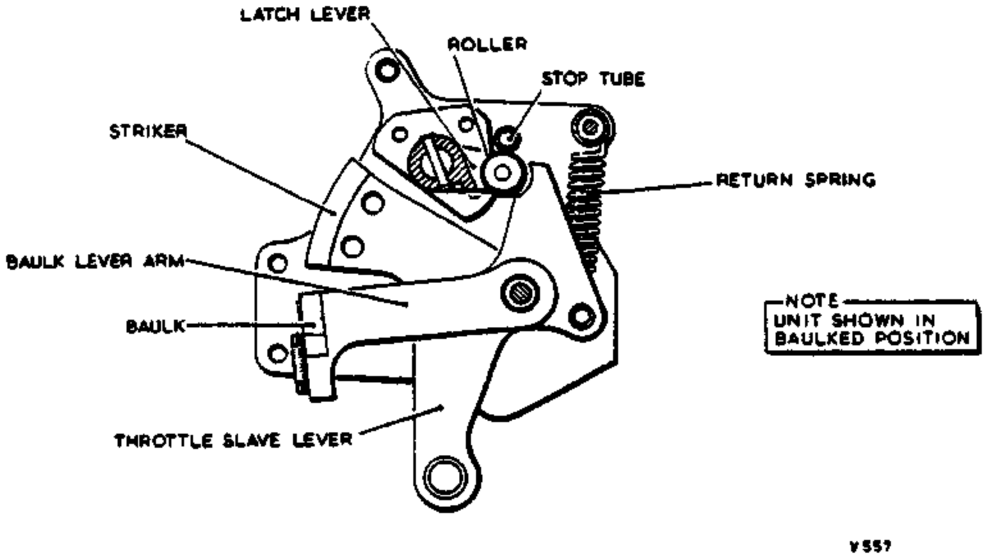
(5) With the roller on the latch lever in contact with the stop tube, tension control cable to 10-15 lb. Make sure the turnbarrel is in safety and lockwire.

(6) Start No.1 and No.2 engines (Chapter 71, GENERAL).

(7) Move the RH throttle lever fully to the 'open' stop. Push forward the LH throttle lever until completely baulked *(Detail D)*

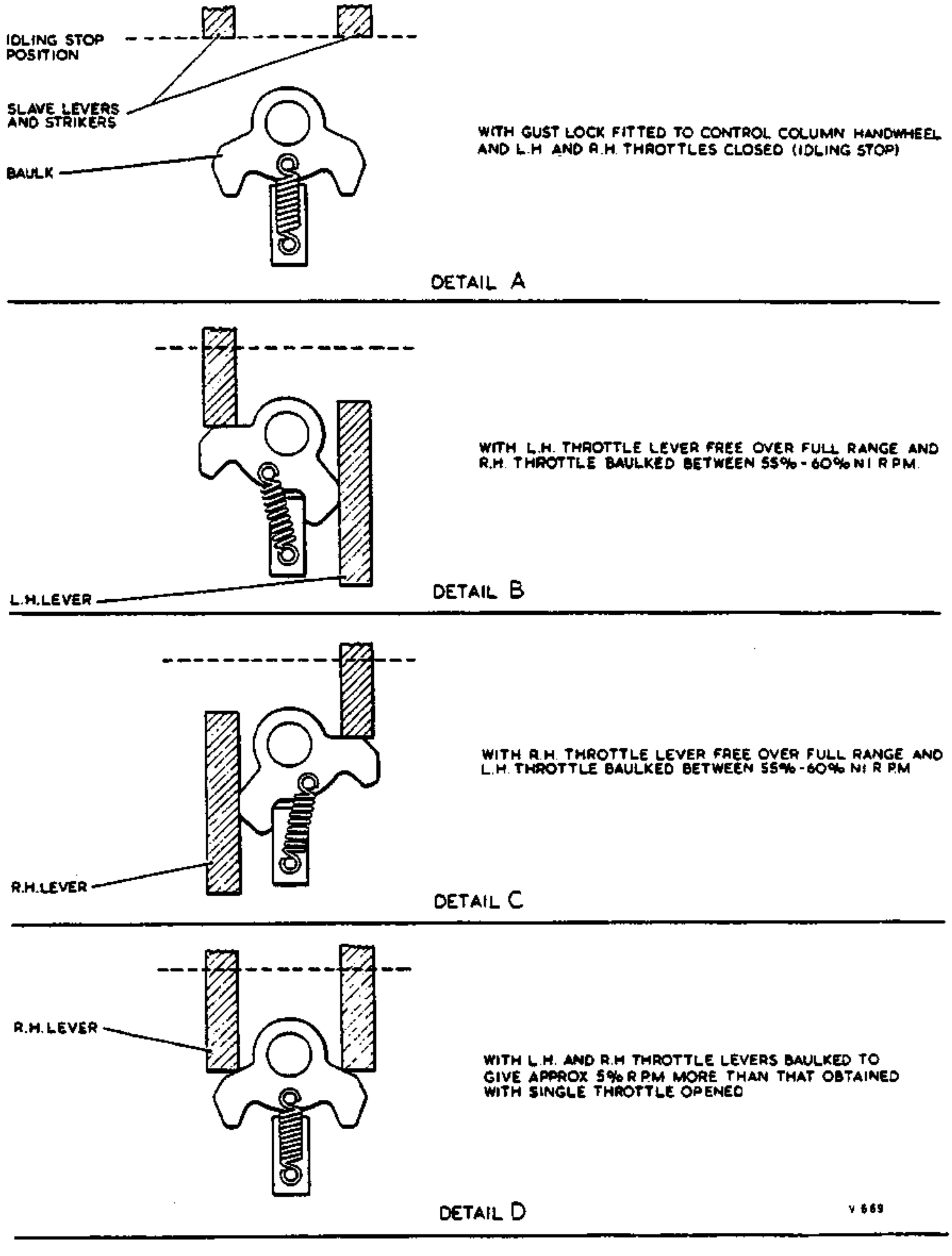


CONTROL SYSTEM DETAILS



BAULK UNIT DETAILS

Rigging procedure
*Figure 501*



WITH GUST LOCK FITTED TO CONTROL COLUMN HANDWHEEL AND L.H. AND R.H. THROTTLES CLOSED (IDLING STOP)

WITH L.H. THROTTLE LEVER FREE OVER FULL RANGE AND R.H. THROTTLE BAULKED BETWEEN 55%-60% N1 R.P.M.

WITH R.H. THROTTLE LEVER FREE OVER FULL RANGE AND L.H. THROTTLE BAULKED BETWEEN 55%-60% N1 R.P.M.

WITH L.H. AND R.H. THROTTLE LEVERS BAULKED TO GIVE APPROX 5% R.P.M. MORE THAN THAT OBTAINED WITH SINGLE THROTTLE OPENED

Throttle levers baulking

*Figure 502*

(8) Make sure that the No.1 engine rpm is not more than 60% $N_1$ and not less than 55% $N_1$. If it is, adjust the LH throttle connecting rod A to obtain the required engine rpm. Install and tighten the connecting rod.

(9) Move both throttle levers back to the 'closed' stops (*Detail A*).

(10) Move the LH throttle lever fully to the 'open' stop. Push forward the RH throttle lever until completely baulked (*Detail C*).

(11) Make sure that the No.2 engine rpm is not more than 60% $N_1$ and not less than 55% $N_1$. If it is, adjust the RH throttle connecting rod A to obtain the required engine rpm. Install and tighten the connecting rod.

*NOTE: Paragraphs (8) and (9), (10) and (11) must be done independently. If both throttle levers are baulked at the same time the rpm reading will be different from paragraphs (8) and (11) because of the geometry of the baulk.*

(12) Release the gust lock from the control column handwheel and back in the spring clip stowage.

(13) Move the LH and RH throttle levers slowly from the fully 'closed' to 'open', then back to 'closed' stops, make sure that there is full and free movement over the whole range with no restriction from the inoperative baulk.

(14) Install and secure the gust lock to the column handwheel.

(15) Push forward the LH and RH throttle levers at the same time towards the 'open' stops, until movement is stopped by the baulk (*Detail B*). Press firmly against the baulk, make sure that each engine rpm is approximately 5% more than that measured in paragraphs (8) and (11).

(16) Pull back both levers to the 'closed' position. Make sure that the LH throttle lever has full and free movement from the 'closed' to 'open' stops when the RH throttle lever is held against the baulk, *and conversely the RH throttle lever when the LH lever is held against the baulk (Detail C and Detail D).*

(17) Release the gust lock from control column handwheel and lock it in the spring clip stowage.

(18) Shut down engine (Chapter 71, GENERAL).

**B. Do a functional test on the gust lock and throttle levers baulk control system**

(1) Start No.1 and 2 engines (Chapter 71, GENERAL).

(2) Install and tighten the gust lock to the first pilot's control column handwheel.

(3) Move the LH (No.1 engine) throttle lever to the full 'open' stop. Push forward the RH (No.2 engine) throttle lever until completely baulked. Push tightly against the baulk and make sure that No.2 engine rpm is not more than 60% $N_1$ and not less than 55% $N_1$.

(4) Move the LH and RH levers back to the 'closed' stops (engine idling).

(5) *Move the RH (No.2 engine) throttle lever to the full 'open' stop. Push forward the LH (No.1* engine) throttle lever until completely baulked. Push tightly against the baulk and make sure that No.1 engine rpm is not more than 60% $N_1$ and not less than 55% $N_1$.

(6) Move the LH and RH levers back to the 'closed' stops (engine idling).

(7) Move the LH (No.1 engine) and RH (No.2 engine) throttle lever at the same time toward the 'open' stops until they are both completely baulked. Push tightly against the baulk and make sure that each engine rpm is approximately 5% more than that measured in paragraphs (3) and (5).

(8) Put back both levers to the 'closed' stops (engine idling).

(9) Release the gust lock from the control column handwheel and lock it in the spring clip stowage.

(10) Move the LH and RH throttle levers at the same time to the 'open' then to the 'closed' stops, and make sure there is full and free movement over whole range.

(11) Stop engines (Chapter 71, GENERAL).

**C. Examine gust lock and throttle levers baulk cable tension**

(1) Install and put the gust lock into the first pilot's control column handwheel.

(2) Move the left-hand (No.1 engine) and right-hand (No.2 engine) throttle levers to the fully 'closed' stops.

(3) Set tensiometer to suit 5 cwt. cable. Remove access panel from the left-hand side of control pedestal and position tensiometer on the vertical section of cable. Make sure that cable tension is 10/15 lb. Remove tensiometer, and install and secure panel.

**D. Do a check of the throttle levers baulk operation**

(1) Install and secure the gust lock to the first pilot's control column handwheel.

(2) Move the LH throttle lever to the full 'open' stop, make sure there is full and free movement over whole range. Push the RH throttle lever towards the 'open' stop until completely baulked.

(3) Move both levers back to the 'closed' stops (engine idling position).

(4) Move the RH throttle lever to the full 'open' stop, make sure there is full and free movement over whole range. Push the LH throttle lever towards the 'open' stop until firmly baulked.

(5) Move both levers back to the 'closed' stops.

(6) Move the LH and RH throttle levers at the same time towards the 'open' stops and make sure that both levers are completely baulked.

(7) Move both levers back to the 'closed' stops.

(8) Release the gust lock from the control column handwheel and lock it in the spring clip stowage.

(9) Move the LH and RH throttle levers at the same time to the 'open', then to the 'closed' stops, make sure there is full and free movement over whole range.

## GUST LOCK - RUDDER - DESCRIPTION AND OPERATION

The gust lock is a straight light alloy tube approximately seventeen inches long incorporating a domed plug riveted into each end. The tube is inserted through a hole in the floor to engage the rudder controls, and is stowed on the shroud forward of the co-pilot's seat mounting.

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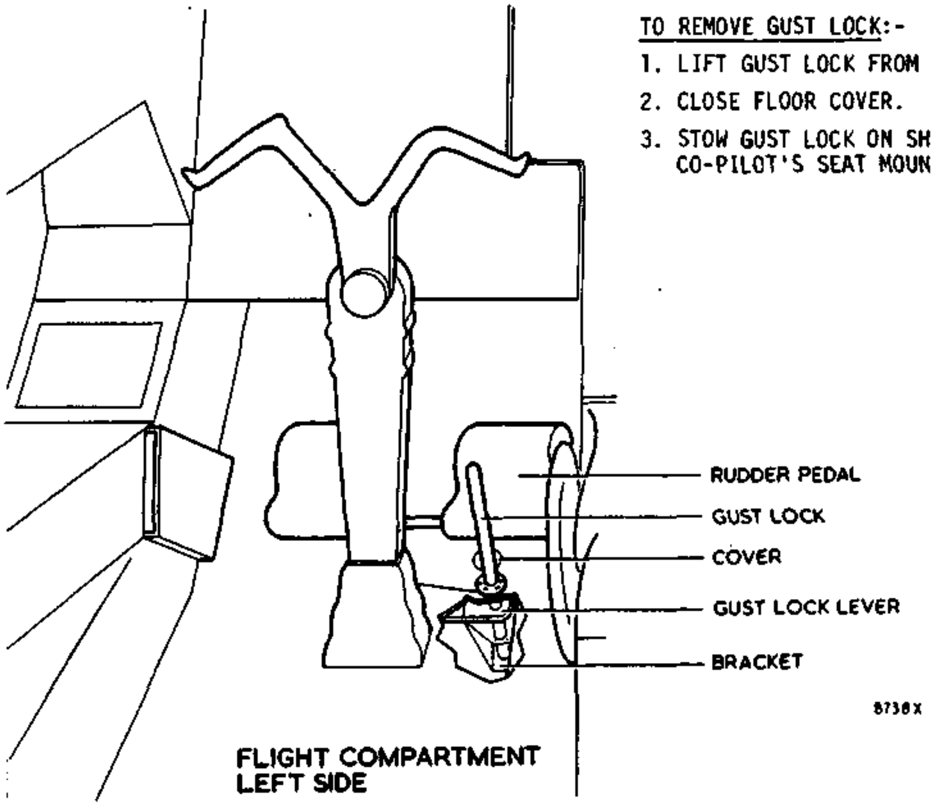
TO FIT GUST LOCK:-

1. REMOVE GUST LOCK FROM STOWAGE.
2. POSITION RUDDER PEDALS AT NEUTRAL.
3. LIFT COVER IN FLOOR AND INSERT GUST LOCK THROUGH GUST LOCK LEVER AND BRACKET.

TO REMOVE GUST LOCK:-

1. LIFT GUST LOCK FROM LEVER AND BRACKET.
2. CLOSE FLOOR COVER.
3. STOW GUST LOCK ON SHROUD FORWARD OF CO-PILOT'S SEAT MOUNTING.



Rudder gust lock installation
Fig.1

* * *

# CHAPTER

# 28

# FUEL

# CHAPTER 28

# FUEL

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## FUEL SYSTEM - GENERAL

### 1. Fuel System - Safety Precautions

When manhole covers are removed or when partial entry into a fuel tank is required, the following precautions must be observed in conjunction with any special precautions detailed in specific maintenance practices.

WARNINGS: 1. AVIATION FUELS ARE FLAMMABLE AND POISONOUS.

2. BEFORE YOU START WORK ON THE FUEL SYSTEM MAKE SURE:
   - FIRE FIGHTING EQUIPMENT IS READILY AVAILABLE AND IN PROXIMITY TO THE WORK AREA.
   - ELECTRICAL POWER IS REMOVED FROM THE AIRCRAFT.
   - THE BATTERIES ARE DISCONNECTED WITH THE BATTERY CABLES STOWED.

3. DO NOT ENTER THE FUEL TANK BEFORE IT IS PURGED OF FUEL FUMES.

4. WEAR PROTECTIVE CLOTHING AND USE REMOTE BREATHING APPARATUS AND EXPLOSION PROOF INSPECTION LAMP.

5. PROLONGED CONTACT WITH FUEL CAN CAUSE SKIN IRRITATION.

6. OVER EXPOSURE TO FUEL VAPOUR CAN CAUSE LETHARGY, SERIOUS ILLNESS OR DEATH.

7. THE MATERIALS WHICH ARE USED IN SOME MAINTENANCE PRACTICES MAY CONSTITUTE A HAZARD OR HEALTH RISK IF CERTAIN SAFETY PRECAUTIONS ARE NOT OBSERVED. IN ALL CASES THE MATERIAL MANUFACTURERS OR SUPPLIERS HEALTH AND SAFETY DATA SHEETS MUST BE REFERRED TO.

CAUTIONS: 1. MAKE A LIST OF ALL TOOLS AND EQUIPMENT TAKEN INTO THE TANK. ITEMS SHOULD BE CHECKED OFF AGAINST THIS LIST AS THEY ARE REMOVED FROM THE TANK.

2. BLANK THE OPEN ENDS OF ALL DISCONNECTED PIPE LINES.

### 2. Fuel System - Description and Operation

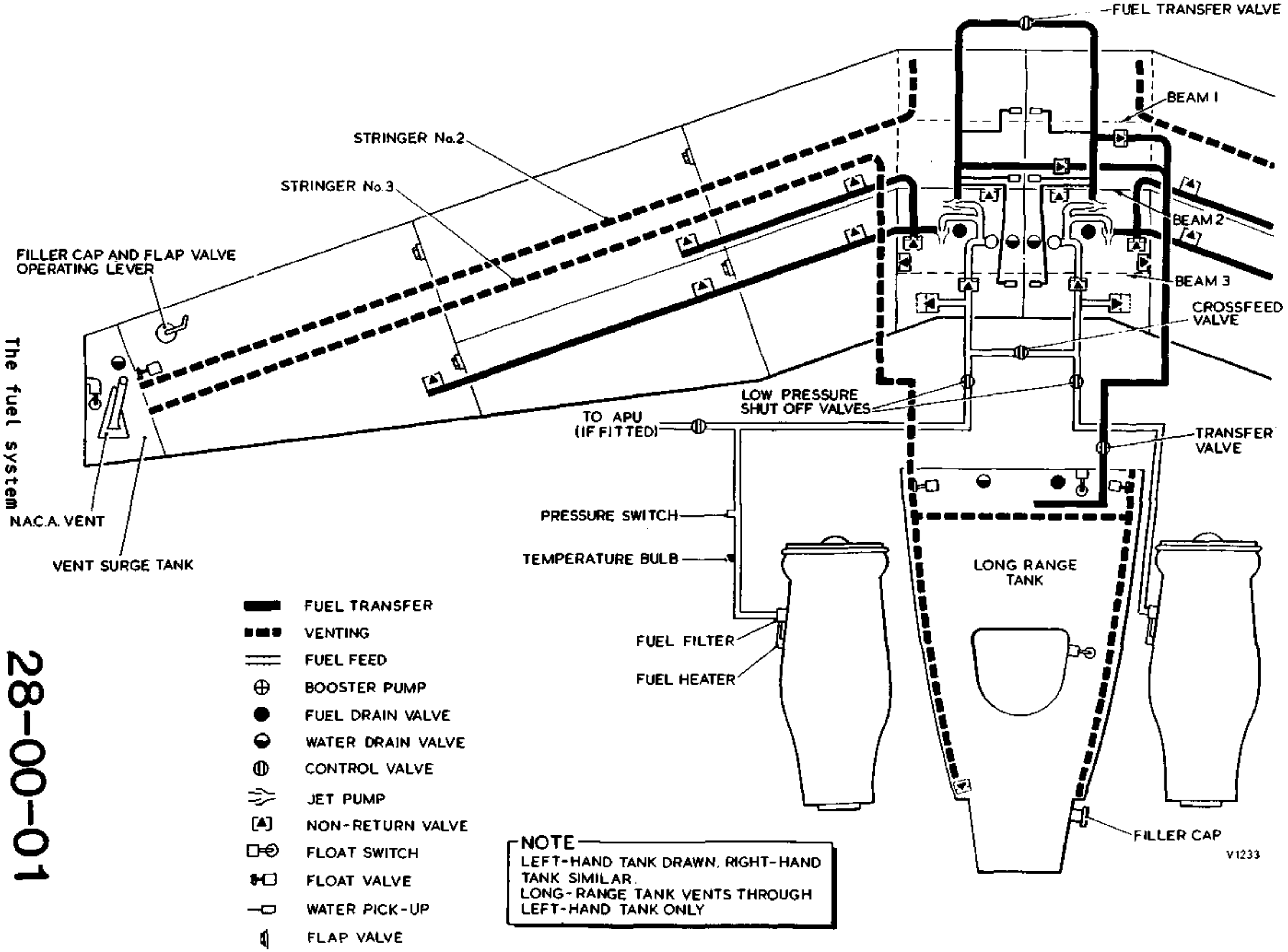
Fuel is stored in an integral tank in each wing and in a long range tank (ventral tank) beneath the rear fuselage. Fuel and water drains are incorporated in the tanks which are refuelled through a filler in each tank. Booster pumps are fitted in each wing tank to supply fuel to the respective engine and an APU if fitted, also to activate a transfer system to feed fuel from the long range tank to the wing tank, or from one wing tank to the other. A crossfeed valve ensures a supply to both engines in the event of a single booster pump failure; the engines can run on suction feed should both pumps fail.

All tanks vent to atmosphere, through a surge tank on each wing tip, the long range tank venting to the left wing tank only. A float switch in each surge tank provides a warning on a magnetic indicator should the surge tank become full during fuel transfer.

A capacitance type contents system is provided for each wing tank and a magnetic indicator operated by high and low level float switches for the long range tank.

A fuel heater, a fuel overheat warning system, a fuel flow transmitter and an engine low pressure fuel filter blocked warning system also form part of the engine mounted fuel system.

In addition to the usable fuel, the wing and long range tanks each carry a small quantity of unusable fuel; most of this unusable fuel is capable of being drained via the water and/or fuel drains.



NOTE
LEFT-HAND TANK DRAWN, RIGHT-HAND TANK SIMILAR.
LONG-RANGE TANK VENTS THROUGH LEFT-HAND TANK ONLY

The fuel system
Fig.1

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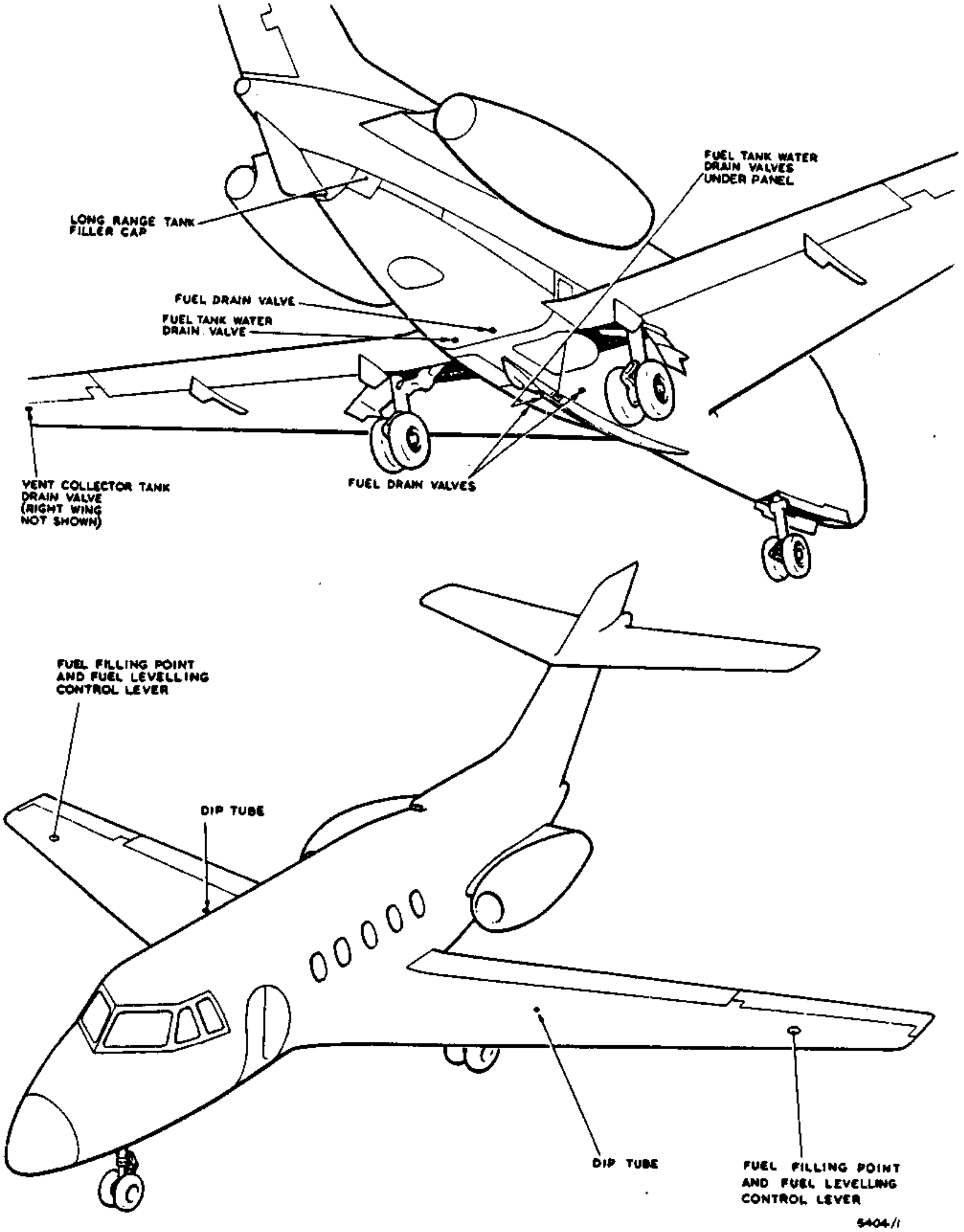

FUEL TANK WATER DRAIN VALVES UNDER PANEL
LONG RANGE TANK FILLER CAP
FUEL DRAIN VALVE
FUEL TANK WATER DRAIN VALVE
VENT COLLECTOR TANK DRAIN VALVE (RIGHT WING NOT SHOWN)
FUEL DRAIN VALVES
FUEL FILLING POINT AND FUEL LEVELLING CONTROL LEVER
DIP TUBE
DIP TUBE
FUEL FILLING POINT AND FUEL LEVELLING CONTROL LEVER
5404/1

Fuel system external details
Fig.2

* * *

# PIPE COUPLINGS AND FITTINGS - MAINTENANCE PRACTICES

## 1. Avimo pipe to pipe couplings (Figs. 201, 202, 203 and 204)

### A. General

When Avimo pipe couplings are disassembled, all O-ring seals in the coupling should be replaced even if only one half of the coupling has been disturbed.

When assembling Avimo pipe couplings, the entry of the pipe into the coupling must be checked to make certain there is no excessive mal-alignment and/or side loading. The pipe must be located on assembly within the coupling such that axial movement is possible in either direction.

### B. Dis-assembly of pipe couplings

(1) For couplings fitted with drain and shroud assembly (Fig.203): Remove drain connection at base of sleeve, release clips securing rubber collar and slide sleeve along pipe to expose coupling.

(2) Remove wirelocking and disconnect pipe to coupling bonding leads.

(3) Undo coupling nut and slide nut and compression ring away from coupling.

(4) Loosen and/or remove sufficient pipe to structure attachments to enable pipe to be withdrawn from coupling. Note positions of all packings used to align pipes.

(5) Discard O-ring seals.

### C. Assembly of pipe couplings

Materials required :-

| | | | |
|---|---|---|---|
| Oil | .. | .. | DEF STAN 91-44 or MIL-L-7870A |
| Seal lubricant | .. | .. | Parker Super-O-Lube 5415406L |

(1) For couplings fitted with drain and shroud assembly (Fig.203) : Position drain sleeve, rubber collars and clips on pipes.

(2) Lubricate new O-ring seals with Super-O-Lube and coupling body threads with oil.

(3) Make certain coupling nut and compression ring are correctly positioned on pipe. Inspect threads of coupling nut and body for serviceability, reject if necessary.

(4) Position new O-ring seal on pipe, position pipe into coupling, slide compression ring along pipe and into coupling.

(5) Tighten nut to fully bottom on coupling body, this is represented by a significant increase in torque when tightening the nut.

NOTE : The amount of thread protruding on the coupling body is not controlled and is not representative of the nut bottoming.

(6) For Avimo Mk.3 couplings (fitted with a compression ring with tapered skirt) :
Check that the compression ring tapered skirt is evenly displayed around the coupling and that the pipe is central within the skirt.

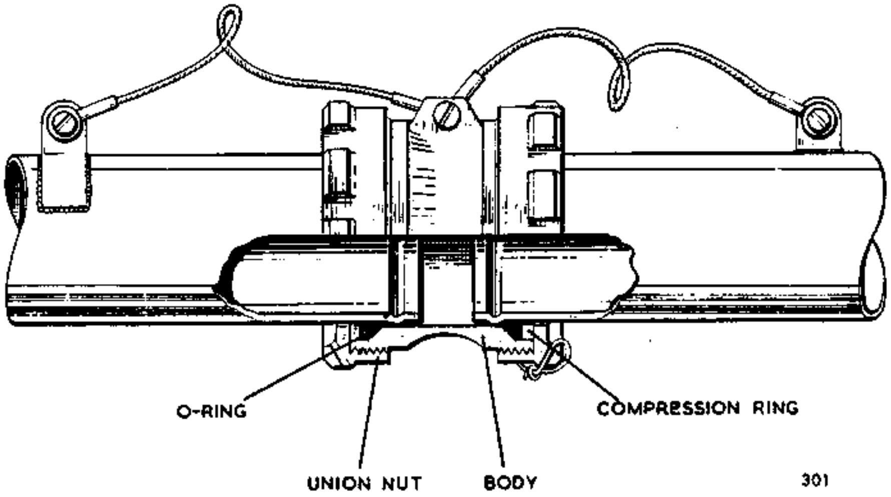
(7) Maintaining correct alignment of pipe alignment to coupling, position and secure all pipe to structure attachments, positioning packing material, as noted during removal, to maintain correct alignment.

(8) Check through out the pipe run that there is adequate clearance between the pipe and adjacent structure and components.

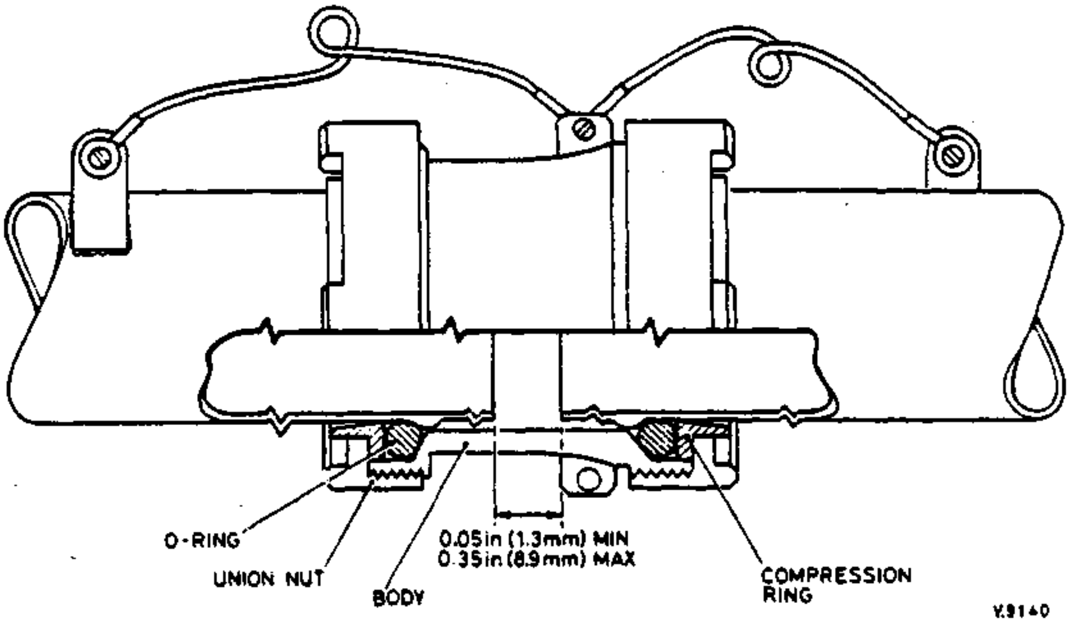
(9) Reconnect the pipe to coupling bonding lead (see Chapter 20, ELECTRICAL BONDING) and wirelock the nut to coupling body.

(10) Flow test the relevant part of the fuel system (see Chapter 28, FUEL FEED SYSTEM). Check no leaks are present.

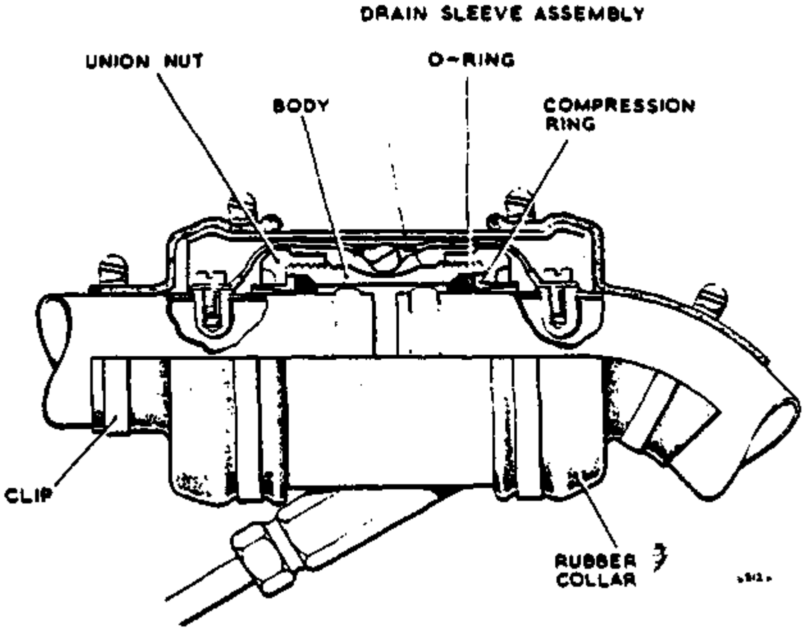
(11) For couplings fitted with drain and shroud assembly (Fig.203) :
Position drain sleeve and rubber collars over coupling, align and connect coupling drain pipe, tighten clips to secure rubber collars.



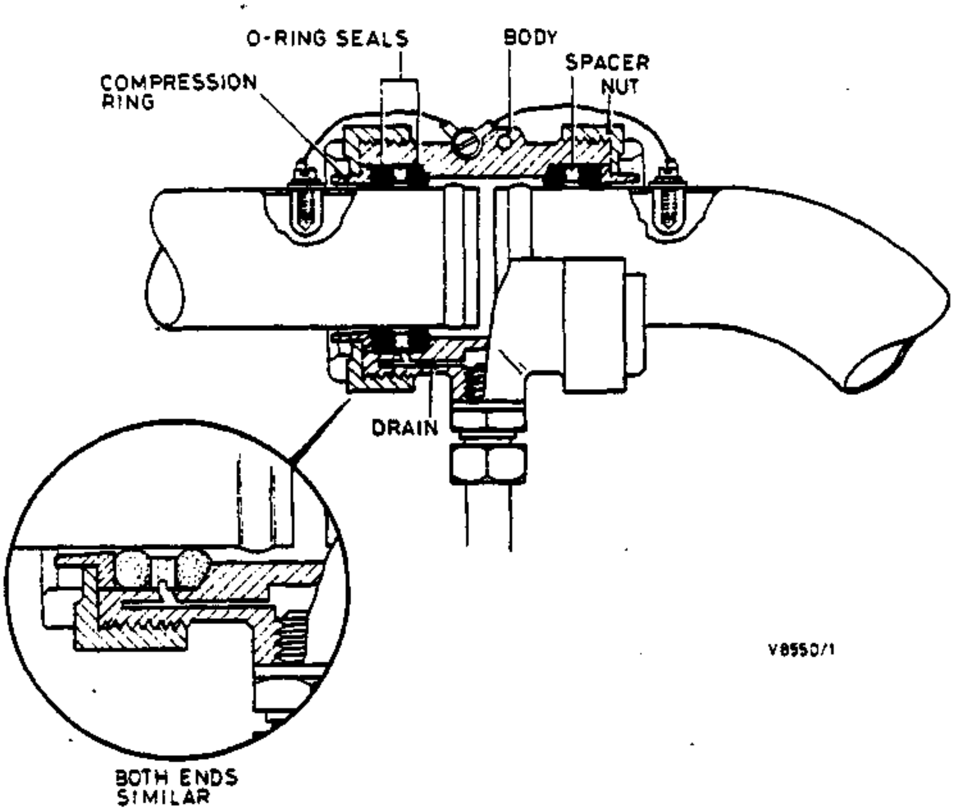
Avimo coupling Mk.1
Fig.201



Avimo coupling Mk.3
Fig.202



Avimo coupling Mk.3 with shroud and drain assembly
Fig.203



Avimo double seal drain coupling
Fig.204

* * *

## STORAGE

### 1. Tanks

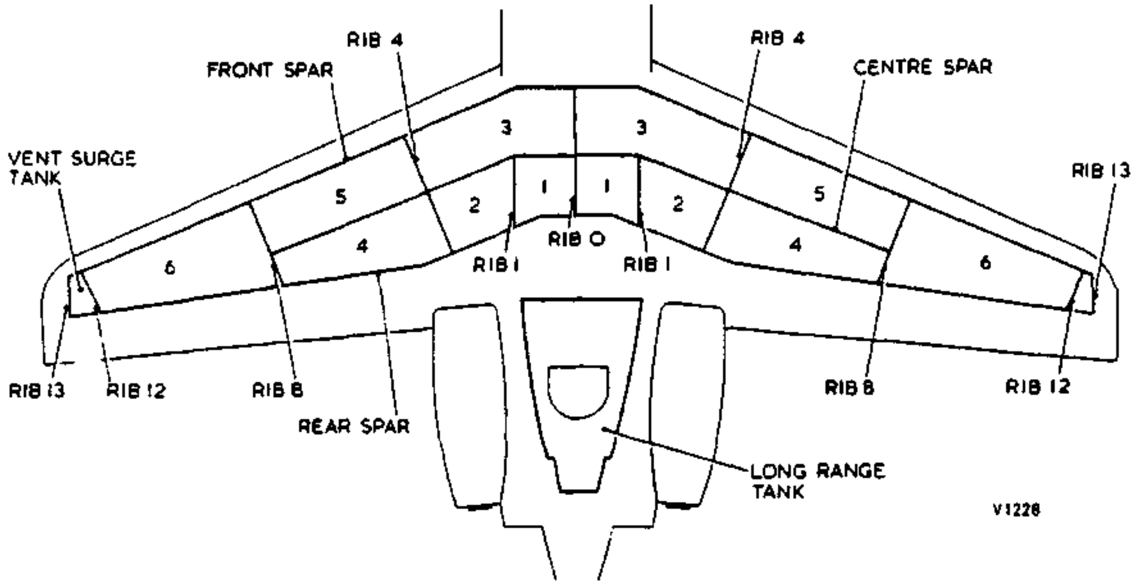
#### A. General (Figs. 1 & 2)

The tanks are formed by sealing the local structure with Thiokol; access to each tank is provided by manhole covers and/or panels.

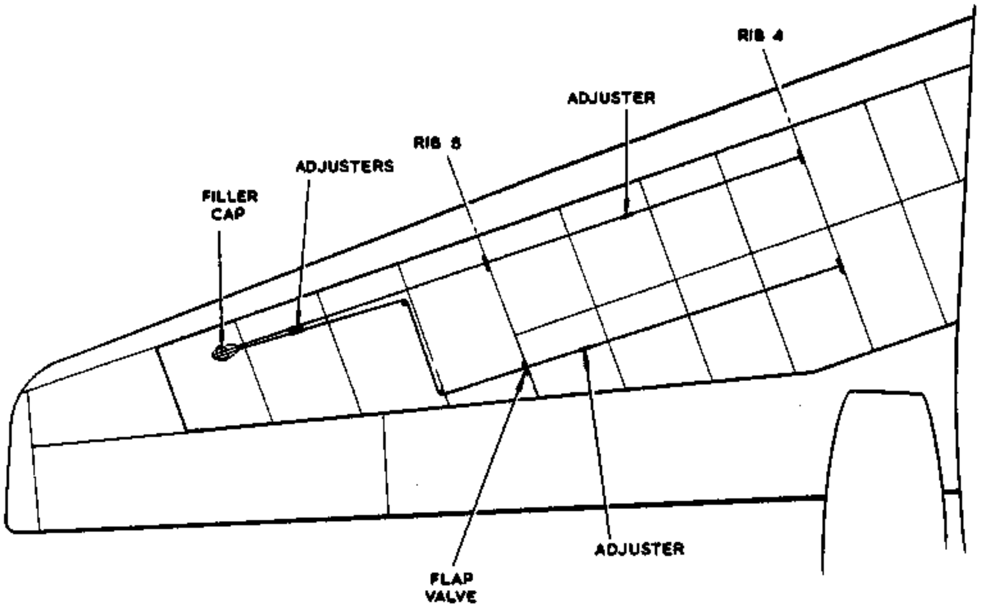
The wing tanks are divided by the spars and ribs into a series of anti-surge compartments; number 1 compartment forming a reservoir in which the booster pump is housed. During normal usage, fuel flows inboard from the outer compartments to number 1 compartment via 2 stringers which form manifolds, each having a non-return valve at the inlet in each compartment. During refuelling, fuel flows inboard via non-return flap valves in the ribs and beams.

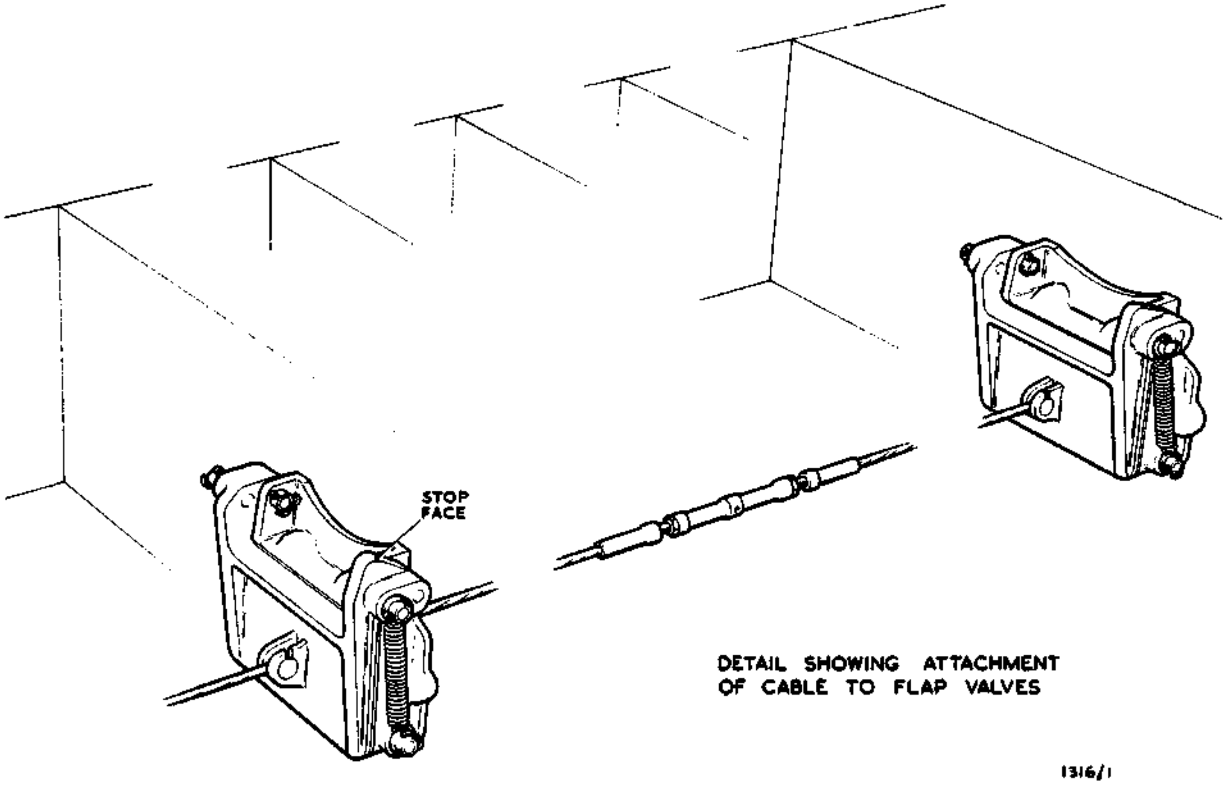
NOTE: Mod.252990 removes all strontium chromate from the aircraft.

A water scavenge system is installed in the wing tanks centre section and operated by the booster pumps. (See Fuel Feed System).



Fuel tanks and compartments
Fig.1





DETAIL SHOWING ATTACHMENT OF CABLE TO FLAP VALVES

Fuel levelling controls
Fig.2

...Storage continued

The wing and ventral (long range) fuel tanks each have a "gravity" refuel cap and fuel and water drain valves. Removal of the wing filler caps automatically operates a fuel levelling system to equalize fuel levels between sealed wing tank compartments during refuelling.

The vent surge (collector) tank, at the tip of each wing, is also sealed with Thiokol and contains a drain valve - similar to the fuel tank water drain valves.

B. Fuel tank usable capacities

Usable tank capacities are quoted to the nearest unit in the following table:-

| Tank | IMP.GAL. Total usable | U.S.GAL. Total usable | LITRES Total usable |
|---|---|---|---|
| WING, LEFT | 512.5 | 615.4 | 2329.7 |
| WING, RIGHT | 512.5 | 615.4 | 2329.7 |
| VENTRAL | 112 | 134.5 | 509.1 |
| TOTAL | 1137 | 1365.3 | 5168.5 |

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2. Ventilation

A. General (Figs.3 and 4)

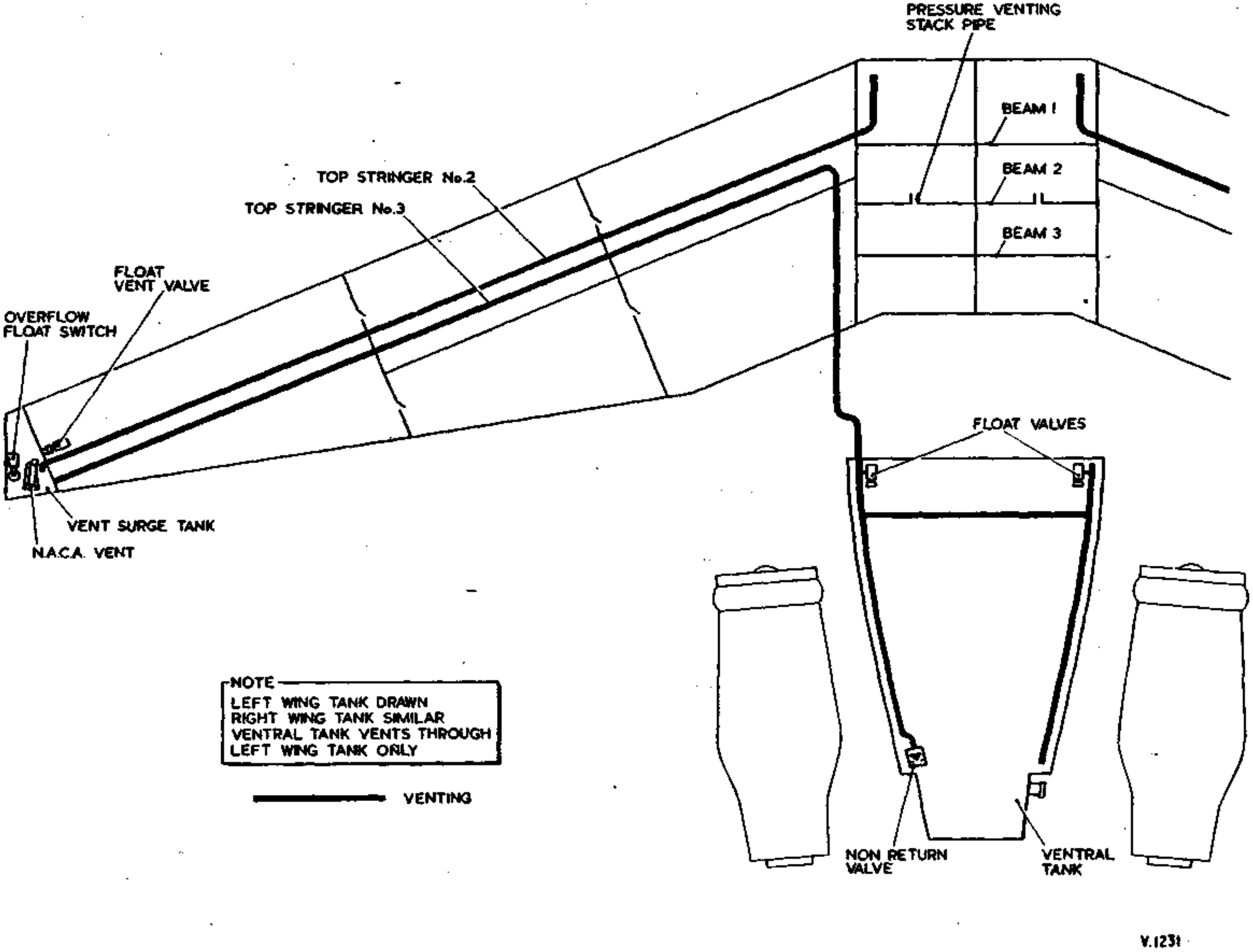
The fuel tanks are all vented to atmosphere through the vent surge tanks which each have a flush "non-icing" air intake. Any fuel which spills into the vent surge tank is drawn back into the wing tanks as their level falls.

Each wing tank is vented, to the vent surge tank, at its outboard end via a float valve and from its inboard end via a stringer in the wing top skin.

The ventral tank vents into the left vent surge tank via float valves and open-ended pipe within the tank and a stringer in the wing tank top skin.

B. Ventral tank (Fig.1)

Two vent pipes, one on each side of the tank, are each connected at the forward end to a vent float valve mounted respectively, one on the left and one on the right of the tank front wall. At the rear, the right-hand pipe is open-ended and the left-hand pipe has a lightly spring-loaded non-return valve; a transverse pipe interconnects the forward end of both pipes.



NOTE
LEFT WING TANK DRAWN
RIGHT WING TANK SIMILAR
VENTRAL TANK VENTS THROUGH
LEFT WING TANK ONLY

Ventilation system
Fig.3

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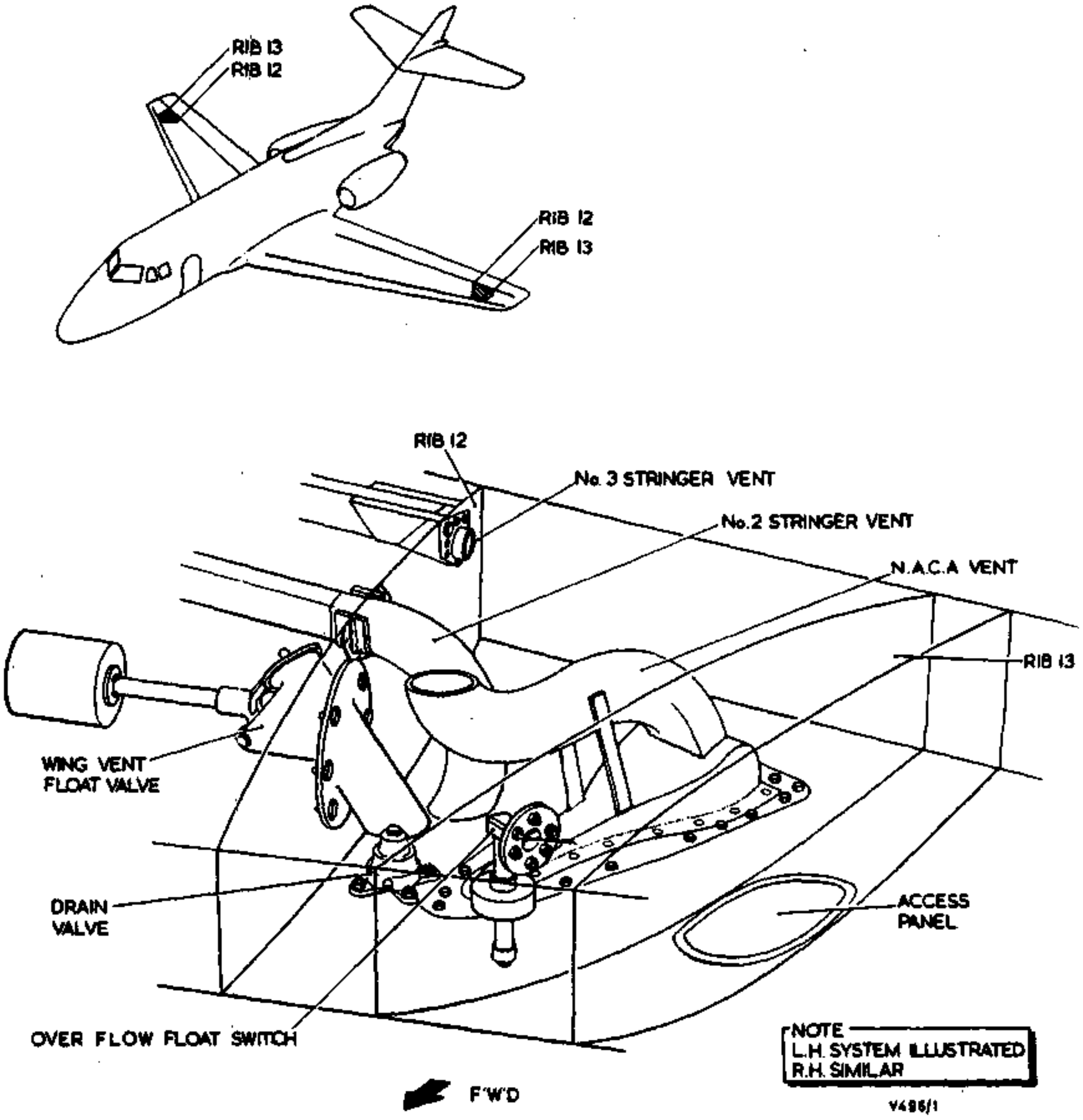

Vent surge tank
Fig.4

...Storage continued

When open, both vent float valves link the front of the tank to the internal vent pipes which, in conjunction with the open end vent line on the right side of the tank, always provide a vent outlet from the tank to the vent surge tank in the left wing, via a pipe and No.3 stringer.

With the aircraft on the ground, and the ventral tank full, the fuel level will cause both vent float valves to close and the tank to vent through the open end of the right-hand vent pipe. In flight, during the climb, the vent lines at the rear of the tank are submerged, but the vent float valves will be open to allow the tank to vent.

The spring-loaded non-return valve in the rear of the left vent pipe provides an emergency vent line in the event of blockage of the transverse interconnecting pipe.

* * *

## STORAGE - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Flow test wing tank venting system

Equipment required :-

| | |
|---|---|
| Air supply to give 60 cu.ft/min. minimum flow rate | |
| Flowmeter rig (with manometer) | HSA.TS.138R. |
| Indicating manometer, 2 lb/sq.in. | HSA.WIDS.196/1. |
| NACA vent inflation adapter | HSA.TS.120R.7. |
| Pressure adapter, surge tank drain valve | HSA.TS.120R.31A. |
| Blank for float valve vent pipe | HSA.TS.120R.21. |
| Blank for No.3 stringer outlet in vent surge tank | HSA.TS.120R.81A. |

(1) Remove the vent surge tank inspection cover and NACA vent assembly (Chapter 28, VENT SURGE TANK). Fit blank(s) to the float valve vent pipe and (in the left-hand surge tank only) to the No.3 stringer vent outlet pipe. Refit vent surge tank inspection cover.

(2) Remove the front manhole cover at inboard end of tank (Chapter 28, MANHOLE COVERS AND ACCESS PANELS). Ensure that the No.2 stringer vent outlet is free from obstruction.

(3) Fit NACA vent inflation adapter to NACA vent and secure with three bolts.

(4) Fit the flowmeter rig three-way adapter to the NACA vent inflation adapter. Connect the flowmeter rig outlet hose to the inlet of the three-way adapter, and the rig manometer inlet to the three-way adapter outlet.

(5) Connect the pressure adapter to the indicating manometer hose.

(6) Connect the flowmeter inlet hose to the air supply.

(7) Open the air supply control valve and, with pressure adapter held in the vent collector tank drain valve, slowly open flowmeter rig gate valve. Check that at a pressure of 1.0 lb/sq.in. (as indicated by the indicating manometer) the flowrate is not less than 40 cu.ft/min. minimum.

(8) Close air supply control valve and flowmeter rig gate valve. Disconnect the flowmeter rig, rig manometer and indicating manometer. Remove all adapters.

(9) Remove the vent surge tank inspection cover. Remove the blanks from the float valve vent and No.3 stringer vent inlet pipes. Refit the vent surge tank inspection cover (Chapter 28, VENT SURGE TANK). Ensure that the vent surge tank drain valve is fully closed.

(10) Refit the manhole cover at the front inboard end of the tank (Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

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...Storage - Maintenance practices continued

## B. Flow test long range tank venting system

Equipment required :-

| | |
|---|---|
| Air supply to give 100 cu.ft/min. flow rate | |
| Flowmeter rig (with manometer) | HSA.TS.138R. |
| Indicating manometer, 2 lb/sq.in. | HSA.WIDS.196/1 |
| NACA vent inflation adapter | HSA.TS.120R.7. |
| Pressure adapter, surge tank drain valve | HSA.TS.120R.31A. |
| Blank for float valve vent pipe | HSA.TS.120R.21. |
| Blank for No.2 stringer inlet in vent surge tank | HSA.TS.120R.21. |

(1) Drain fuel tanks (see Chapter 12).

(2) Remove the left-hand vent surge tank inspection cover and NACA vent assembly (Chapter 28, VENT SURGE TANK). Fit a blank to the float valve vent pipe and to the No.2 stringer inlet vent pipe. Refit vent surge tank inspection cover.

(3) Fit the NACA vent inflation adapter to NACA vent and secure with three bolts.

(4) Fit the flowmeter rig three-way adapter to the NACA vent inflation adapter. Connect the flowmeter rig outlet hose to the inlet of the three-way adapter and the rig manometer inlet to the three-way adapter outlet.

(5) Connect the pressure adapter to the indicating manometer hose.

(6) Remove the filler cap from the left wing fuel tank.

(7) Connect the flowmeter inlet hose to the air supply.

(8) Open the air supply control valve and, with the pressure adapter held in the vent surge tank drain valve, slowly open flowmeter rig gate valve to a pressure of 1.0 lb/sq.in. (as indicated on the indicating manometer). Close supply control valve. Check there are no leaks over a period of 5 minutes and then release pressure.

(9) Remove long range tank filler cap and check that with air pressure maintained at 1.0 lb/sq.in. flow rate is not less than 31 cu.ft/min. and air is flowing from long range tank filler.

(10) Close air supply control valve and flowmeter rig gate valve. Disconnect the flowmeter rig and remove all adapters.

(11) Remove the vent surge tank inspection cover. Remove the blanks from the vent float valve and No.2 stringer vent pipes. Refit the vent surge tank inspection cover (Chapter 28, VENT SURGE TANK). Ensure that the vent surge tank drain valve is fully closed.

(12) Fit the long range and left wing tank filler cap.

## C. Flow test long range tank venting system - tank removed

Equipment required :-

| | |
|---|---|
| Flowmeter rig (with manometer) | HSA TS-138R |
| Adapter for tank vent connection | HSA TS-120R-79A |
| Blank for end of vent pipe | HSA TS-8R-1-13 |

Air supply to give 60 cu.ft./min. minimum flow rate.

NOTE : Ensure flowmeter is calibrated to read at 1.0 lb./sq.in. applied pressure.

(1) Remove access panels from top of tank (see Chapter 28 MANHOLE COVERS AND ACCESS PANELS).

(2) Invert tank to close both vent float valves.

(3) Fit adapter to vent connection at front of tank.

(4) Ensure test rig hoses are free from obstruction, close control valve and water drain cock.

(5) Connect rig inlet to air supply, and outlet to adapter on vent connection.

(6) Remove cap assembly from top of manometer and slowly open the rig control valve, stabilize the pressure at 1.0 lb./sq.in., as indicated by manometer.

(7) Check that the airflow from the rear of the right-hand vent pipe is at least 45 cu.ft./min.

(8) Turn off air supply, turn tank right way up, and fit blank to right-hand vent pipe.

(9) Restore air supply at 1.0 lb./sq.in. and ensure that a full, unobstructed flow of air issues from each vent float valve.

(10) Manually operate each vent float valve in turn, and ensure that flow ceases when valve is raised : ensure that float arms are free.

(11) Turn off air supply, disconnect test rig and remove blank and adapter from vent pipe.

(12) Fit transit blank vent pipe to front of tank and fit access panels (see Chapter 28 MANHOLE COVERS AND AND ACCESS PANELS).

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continued overleaf

...Storage - Maintenance practices continued

## 2. Cleaning/Painting

### A. Shock, biocidal, treatment of wing tanks

NOTE : Complete this treatment either prior to commencing the initial routine preventative biocidal treatment or when contamination is known or suspected to exist.

Material and equipment required :-

Biobor JF
Clean 5 gal.containers - 2 off
Open-ended mobile container approx. 10 gal. capacity
Measuring containers graduated to 1 gal. - 2 off
Flexible extension drain hose to fit engine fuel feed pipes

(1) Defuel tanks (see Chapter 12, SERVICING - FUEL).

CAUTION: THIS FUEL MAY BE CONTAMINATED - IT MUST BE FILTERED (5 MICRONS) AND TREATED WITH BIOBOR JF BEFORE IT IS RETURNED TO AIRCRAFT TANKS.

(2) Drain residual fuel through fuel and water drains.

(3) Disconnect the fuel feed pipe from each engine LP filter. Blank off engine fuel inlet and fit flexible hose to fuel feed pipe. Lead hose into container.

(4) Fill the 5 gal. containers with clean filtered fuel.

(5) Designate a container for left wing and the other for the right wing. To each container, add one sixth pint of Biobor JF for every 100 gal. of fuel required to fill its respective wing tank. Thoroughly mix the Biobor with the fuel.

WARNING: OBSERVE PRECAUTIONS SPECIFIED BY MANUFACTURER OF BIOBOR JF.

(6) Remove overwing filler caps.

(7) Ensure that the cross-feed and low pressure valves are closed.

(8) Pour 1 gal. of the mixed fuel into each wing overwing filler orifice.

(9) Commence refuelling (see Chapter 12, SERVICING - FUEL). At one fifth full and at every additional one fifth contents, repeat operation (8) until all the pre-mixed fuel is in the tanks with all wing tanks full.

(10) Open l.p. cocks and run l.p. booster pumps until fuel flows from each feed hose into containers. Switch off pumps and close l.p. cocks. Remove container and dispose of its contents.

(11) Fit tank caps and allow aircraft to stand for a minimum of 4 days.

(12) Repeat operations (1) and (2).

(13) Examine drained fuel. If microbiological debris is apparent, remove microbiological debris deposits as described in para.2.C. before proceeding.

NOTE : See Structural Repair Manual for tank access and repair details. See Maintenance Schedule for inspection details.

(14) Refuel each wing tank with 60 Imp. Gal. of clean fuel containing Biobor JF at a concentration of 270 p.p.m. (20 p.p.m. Boron max.).

(15) Repeat operation (10) checking that fuel is free from microbiological debris.

(16) Remove the flexible hose from the fuel feed pipe and the blank from the engine inlet. Connect l.p. hose to each engine and fit new l.p. filter.

(17) CAUTION : UNDER NO CIRCUMSTANCES MAY FUEL WITH A CONCENTRATION OF BIOBOR IN EXCESS OF 270 PPM BY BURNT BY THE ENGINES.

(18) Ground run both engines (see Chapter 71, POWER PLANT - General) :-

(a) Start engines and warm up at 60% rev/min. for 5 minutes.

(b) Run each engine at 90% for one minute and then 60% rev/min. for one minute.

(c) Stop engines.

(19) Inspect low pressure fuel filter and re-inspect at intervals specified in the Maintenance Schedule.

NOTE : If microbiological debris is seen in filter, proceed as in operation (13).

(20) Comply with requirements of para.2.B., preventative biocidal treatment of wing tanks.

B. Preventative, biocidal, treatment of wing tanks

NOTE : Prior to initial implementation of this treatment, comply with requirements of para.2.A.

(1) Permanently operate aircraft using fuel treated with an approved biocidal additive as detailed in either (a) or (b).

(a) Methyl Cellosolve (D.Eng.RD 2451 issue 2) or equivalents at a concentration of 0.15% by volume.

(b) Biobor JF at a concentration of 135 p.p.m. max. (10 p.p.m. Boron max.).

(2) At intervals not exceeding 24 hours, drain water accumulations from tanks of aircraft which have not flown during the 24 hours period.

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...Storage - Maintenance practices continued

## C. Tanks-Removal of microbiological debris deposits

Materials and equipment required :-

| | |
|---|---|
| Nonidet LE detergent | as required |
| Methanol BS.506 | as required |
| Long handled hard bristle brush (or attached to a broom pole) | 1 for each operator |
| Cellulose sponge attached to a broom pole | |
| A supply of clean, dry, heated, compressed air | |

NOTE : Air supply from a workshop compressor can only be used if filtered to remove all impurities, especially moisture.

| | |
|---|---|
| Suitable clean containers. | 2 off |

(1) Complying with CAUTION para.2.A(1)

(2) Remove the underwing manhole covers and access panels (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(3) Remove the wing tank front and rear spar access panels.

NOTE : Obtaining access to the front and rear spar wing tank access panels constitutes a structural repair, for details refer to the Structural Repair Manual.

(4) Mix a solution of detergent; proportion ½ pint detergent, 1 gal. water.

(5) Through the manholes and access panels, using the brush or a suitably long handle, thoroughly scrub the areas with the mixed detergent.

NOTE : Tank compartments 2 and 3 are likely to present the worse contaminated areas.

(6) Rinse out with clean water to remove detergent, scrubbing as necessary to remove all microbiological debris. When the areas are clean, mop up and remove all excess water with the sponge.

(7) WARNING : METHANOL IS POISONOUS AND MAY BE ABSORBED BY THE SKIN. RUBBER GLOVES MUST BE WORN AND ANY SKIN CONTAMINATION MUST BE IMMEDIATELY WASHED OFF WITH CLEAN WATER.

Mix a 50/50 solution of methanol and water. Do not under any circumstances exceed 50% of methanol in the solution.

(8) Apply the methanol solution to the areas and leave for 15 minutes to kill any remaining microbiological spores.

(9) After 15 minutes and before two hours from application, remove all traces of methanol solution by rinsing with clean water. After rinsing, drain off the water and mop up puddles with the sponges.

...Storage - Maintenance practices continued

(10) Completely dry out the tanks with the heated compressed air.

(11) Examine tanks for corrosion and degraded sealant. Repair as necessary as detailed in the Structural Repair Manual.

(12) Fit manhole covers (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(13) Fit front and rear spar tank access panels, refer to the Structural Repair Manual.

(14) Complete operations (13) to (19) of para.2.A.

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* * *

# TANKS - MAINTENANCE PRACTICES

**WARNING: FOLLOW ALL WARNINGS AND CAUTIONS GIVEN IN CHAPTER 28-00-00, AVIATION FUEL IS FLAMMABLE AND POISONOUS.**

## 1. Servicing

### A. Classification of leaks

(1) Acceptable leakage:

(a) Slight seepage that shows no signs of forming into drips or runs, except as in (3) below.

(2) Leakage that requires temporary rectification:

(a) Wing tanks:

- Not more than 1 drip a second, inboard of rib 8.
- Not more than 3 drips a second, outboard of rib 8.

(b) Long range tank:

- Not more than 3 drips a second.

*NOTE: Do a permanent repair at the earliest opportunity.*

(3) Leakage that requires immediate permanent repair:

(a) Any leak caused by a crack or other structural damage or defect.

(b) Any leak in excess of those quoted in paragraph A.(2).

### B. Drain tank and purge of fumes:

| Equipment/Material | Part/Item No. |
|---|---|
| Venturi exhauster | Local supply |
| Compressed air supply | Local supply |

(1) Defuel the tank (Chapter 12 SERVICING - FUEL).

(2) Drain any residual fuel through the fuel and water drains.

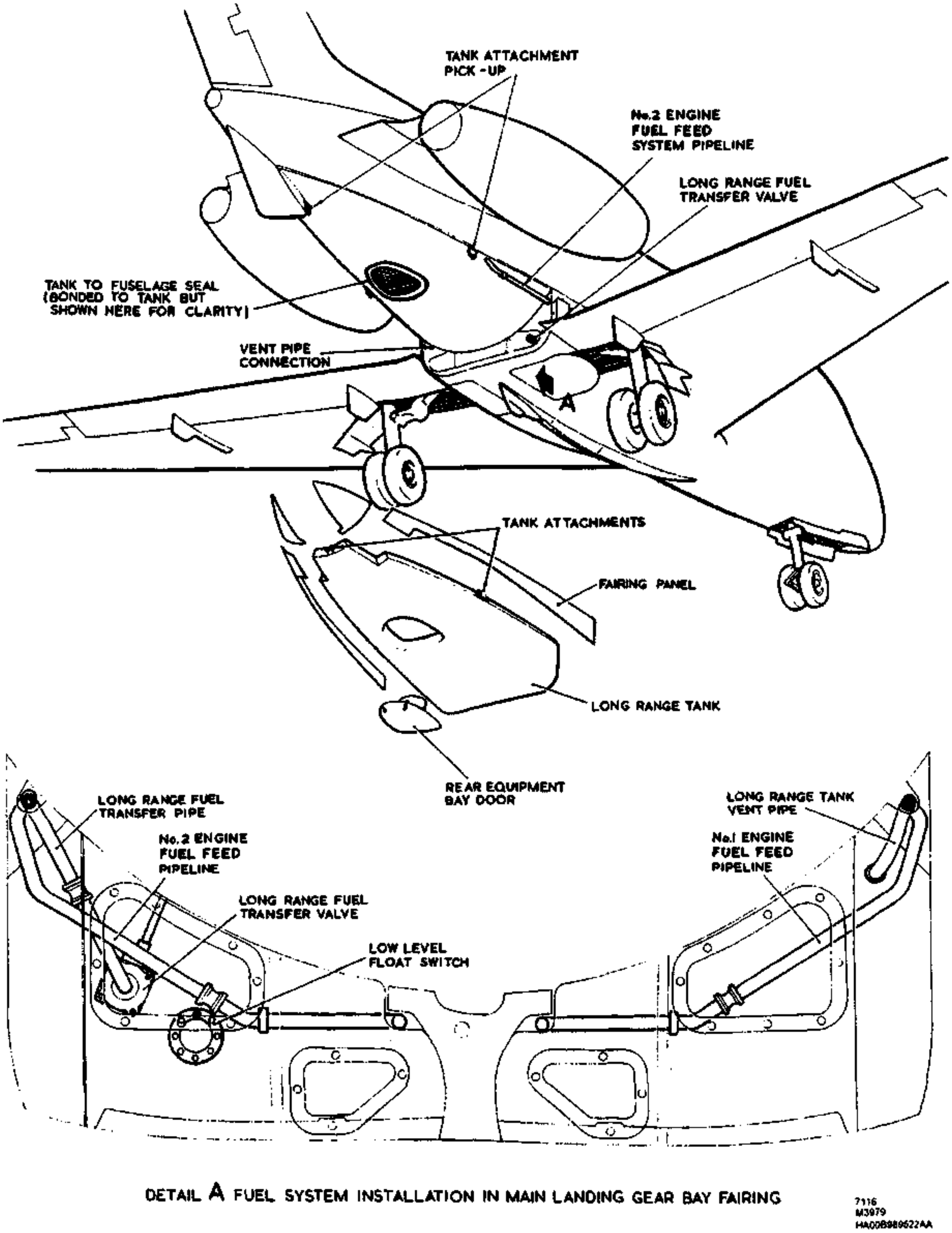
(3) Remove the tank manhole cover(s) (MANHOLE COVERS AND ACCESS PANELS).

(4) Remove the filler cap. Install a suitable venturi exhauster, to which a compressed air supply can be connected.

(5) Connect the air supply, maintain a flow of air until all traces of fumes have been removed from the tank.

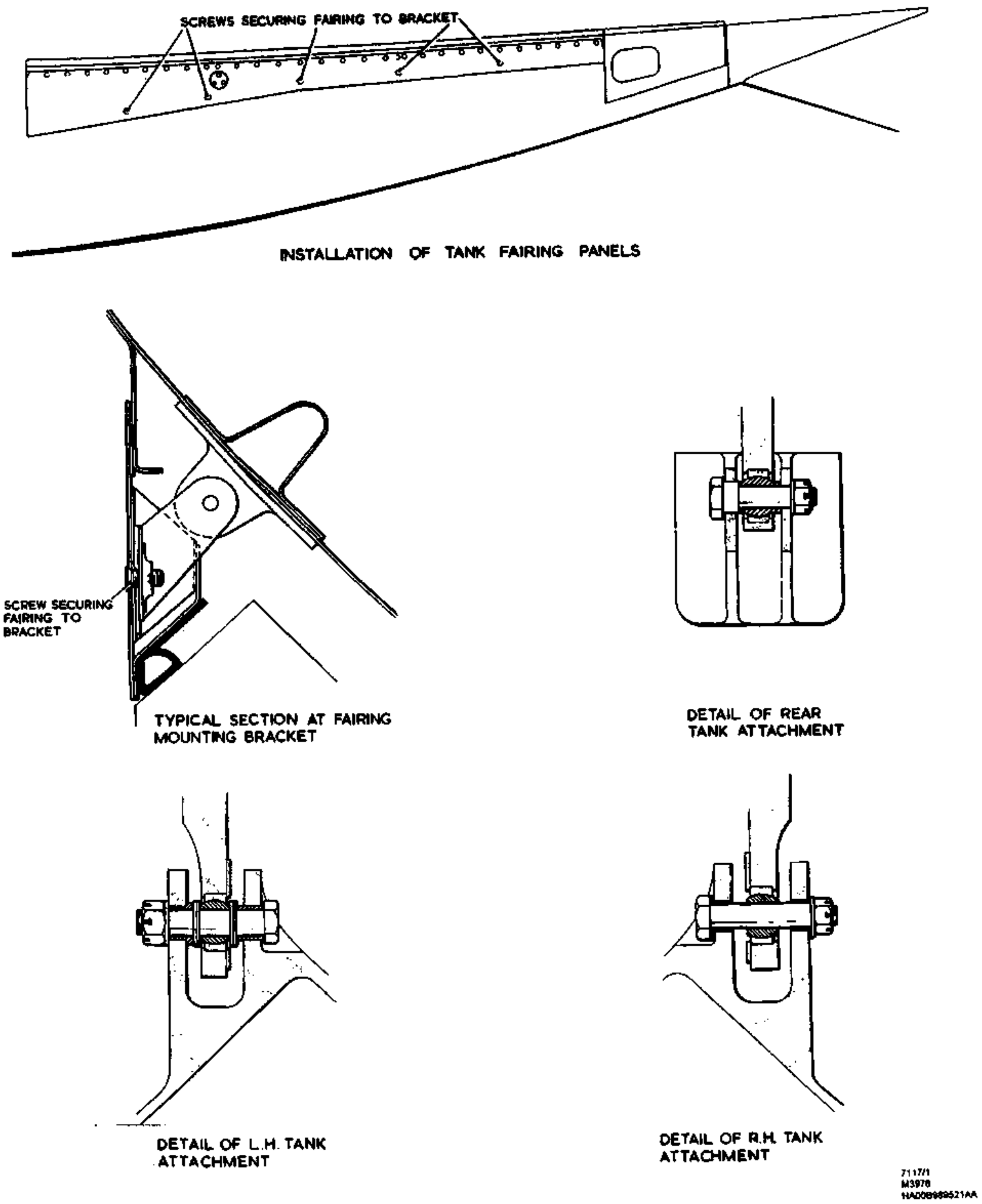
(6) Disconnect the air supply. Remove the exhauster. Install the filler cap.

(7) When the associated maintenance to the tank has been completed install the fuel drain and manhole cover(s) (MANHOLE COVERS AND ACCESS PANELS).


TANK ATTACHMENT PICK -UP
No.2 ENGINE FUEL FEED SYSTEM PIPELINE
LONG RANGE FUEL TRANSFER VALVE
TANK TO FUSELAGE SEAL (BONDED TO TANK BUT SHOWN HERE FOR CLARITY)
VENT PIPE CONNECTION
A
TANK ATTACHMENTS
FAIRING PANEL
LONG RANGE TANK
REAR EQUIPMENT BAY DOOR
LONG RANGE FUEL TRANSFER PIPE
No.2 ENGINE FUEL FEED PIPELINE
LONG RANGE FUEL TRANSFER VALVE
LOW LEVEL FLOAT SWITCH
LONG RANGE TANK VENT PIPE
No.1 ENGINE FUEL FEED PIPELINE
DETAIL A FUEL SYSTEM INSTALLATION IN MAIN LANDING GEAR BAY FAIRING
7116
M3979
HA00B989622AA

Long range fuel tank installation

*Figure 201 (Sheet 1)*


SCREWS SECURING FAIRING TO BRACKET
INSTALLATION OF TANK FAIRING PANELS
SCREW SECURING FAIRING TO BRACKET
TYPICAL SECTION AT FAIRING MOUNTING BRACKET
DETAIL OF REAR TANK ATTACHMENT
DETAIL OF L.H. TANK ATTACHMENT
DETAIL OF R.H. TANK ATTACHMENT
7117/1
M3978
HA00B989521AA

Long range fuel tank installation
*Figure 201 (Sheet 2)*

## 2. Removal/installation

### A. Remove the long range tank *(Figure 201)*

| Equipment/Material | Part/Item No. |
|---|---|
| Door jack clamp | 25Y1491A |

(1) Open the long range tank fuel transfer valve and transfer fuel to the wing tanks, or defuel the tank.

(2) Remove the screws which secure the rear fairing panels behind the tank and remove the panels.

(3) Remove the screws which secure the top edge of the tank fairings to the mounting strip on the fuselage.

(4) Remove the screws which secure the tank fairings to the mounting brackets and remove the fairings.

(5) Make sure that the landing gear locking pins are installed (Chapter 10, PARKING AND MOORING).

(6) Release the pressure from the hydraulic system (Chapter 29, HYDRAULIC POWER).

(7) Lower the right main landing gear door and install door clamp 25Y1491A.

(8) Remove the outboard access panel in the rear wall of the right main wheel bay, to gain access to the long range tank fuel transfer valve and the float switch junction block.

(9) Isolate electrical circuits to the long range tank float switches (Chapter 24, ELECTRICAL POWER).

(10) Disconnect the float switch cables from the junction block and remove the retaining bolt securing the 'P'-clip on the cables to the junction block.

(11) Disconnect the fuel feed pipe from the long range tank transfer valve; disconnect the bonding strip.

(12) Slacken the pinch bolt which secures the valve stop lever to the valve spindle.

(13) Slide the lever up the splined shaft, clear of the valve spindle and tighten the bolt.

(14) Remove the access panel in the fuselage side, situated above the wing trailing edge.

(15) Disconnect the long range tank vent pipe and bonding strip.

(16) Open the rear equipment bay door and support door, remove the pip-pins from the door struts and hinge, and remove the door.

(17) Support the tank and remove the three tank attachment bolts; note the position of the locating washers on the left attachment bolt.

*NOTE: Two men are required on each side of the tank to take the weight, the rear men will place one arm underneath, and gain a grip at the door opening.*

(18) Ease the tank rearwards and downwards, make sure that the fuel transfer valve and vent pipe adapter do not foul the structure, and move the tank clear of the airplane.

(19) Blank the airplane and fuel tank pipelines. Install long range tank.

**B. Install long range tank**

| Equipment/Materials | Part/Item No. |
|---|---|
| Grease | 078 (Chapter 20-95-11) |
| Sealant | 316 (Chapter 20-95-301) |

(1) Remove blanks from the airplane and fuel tank pipelines.

(2) Inspect the tank/fuselage seal around the rear equipment bay door, and change if necessary.

*NOTE: The seal is bonded to the tank with sealant.*

(3) Lubricate the tank attachment bolts with grease.

(4) Offer the tank up to the airplane, make sure that the transfer valve and the vent pipe adapter do not foul the structure.

(5) Install the bushes and attachment bolts make sure that the washers in the left attachment installation are positioned as noted in paragraph 2.A.(17).

*NOTE: If a new tank has been installed, position the washers to centralize the tank so that the fairings and the air conditioning exhaust duct are installed correctly.*

(6) Install the washers and slotted nuts, tighten the nuts and install the split pins.

(7) Connect and tighten vent pipe at the front of the tank, install the bonding strip.

(8) Connect the cables for the float switches to the junction block situated behind the right main wheel bay, and install the bolt securing cable 'P'-clip to the low-level float switch.

(9) Slacken the pinch-bolt in the fuel transfer valve spindle, (make sure that the master spline is engaged) and tighten the pinch-bolt.

(10) Check the valve for correct operation.

(11) Connect and tighten the fuel feed pipe to the transfer valve; install the bonding strip.

(12) Restore the electrical supply to the float switches.

(13) Flow test the long range venting system (Chapter 28, FUEL).

(14) Refuel the tank (Chapter 12, SERVICING - FUEL) and do the fuel transfer test (Chapter 28, FUEL - FEED SYSTEM).

(15) Install the access panel in the right main wheel bay, and remove the wheel bay door jack clamp.

(16) Install the access panel in the fuselage side above the left wing trailing edge.

(17) Install the tanks/fuselage fairing side panels.

(18) Install the tank/fuselage fairing rear panels.

## 3. Approved repairs

### A. Temporary external repair using Leak stopper (Oyltite-Stick)

| Equipment/Materials | Part/Item No. |
|---|---|
| Leak stopper | 332 (Chapter 20 -95-301) |
| Solvent | 262 (Chapter 20 -95-201) |

*NOTE: Leak stopper (Item 332) can be removed with a clean, lint free cloth, moistened with solvent (Item 262).*

(1) Refer to paragraph 1.A. Assess the leak to make sure that a temporary repair is applicable, make sure that the surface is free from hydraulic fluid, grease, or jointing compound.

**CAUTION: DO NOT ATTEMPT TO RECTIFY THE LEAK BY TIGHTENING THE BOLT, THIS WILL DISTURB THE SEALANT UNDER THE BOLT HEAD, AND AGGRAVATE THE LEAK.**

(2) Remove the film from one end of the leak stopper (Item 332).

(3) Rub the leak stopper (Item 332) vigorously into the leak area, until the material is forced into the source, and the leak is stopped; if adhesion cannot be obtained, off-load fuel to below the leak level.

*NOTE: On extremely smooth surfaces, cut off a small portion of the leak stopper (Item 332) and push firmly into the leak source with a flat or suitable tool, until the leak has stopped. Do not score the tank surface.*

(4) Firmly push on an overlay of leak stopper (Item 332) for extra protection.

### B. Temporary repair using bolt sealing fixtures

| Equipment/Materials | Part/Item No. |
|---|---|
| Sealing fixture | Tool No. J72783 |
| Sealant | 316 (Chapter 20 -95-301) |
| Solvent | 230 (Chapter 20 -95-201) |
| Cleaning solvent | 204 (Chapter 20 -95-201) |

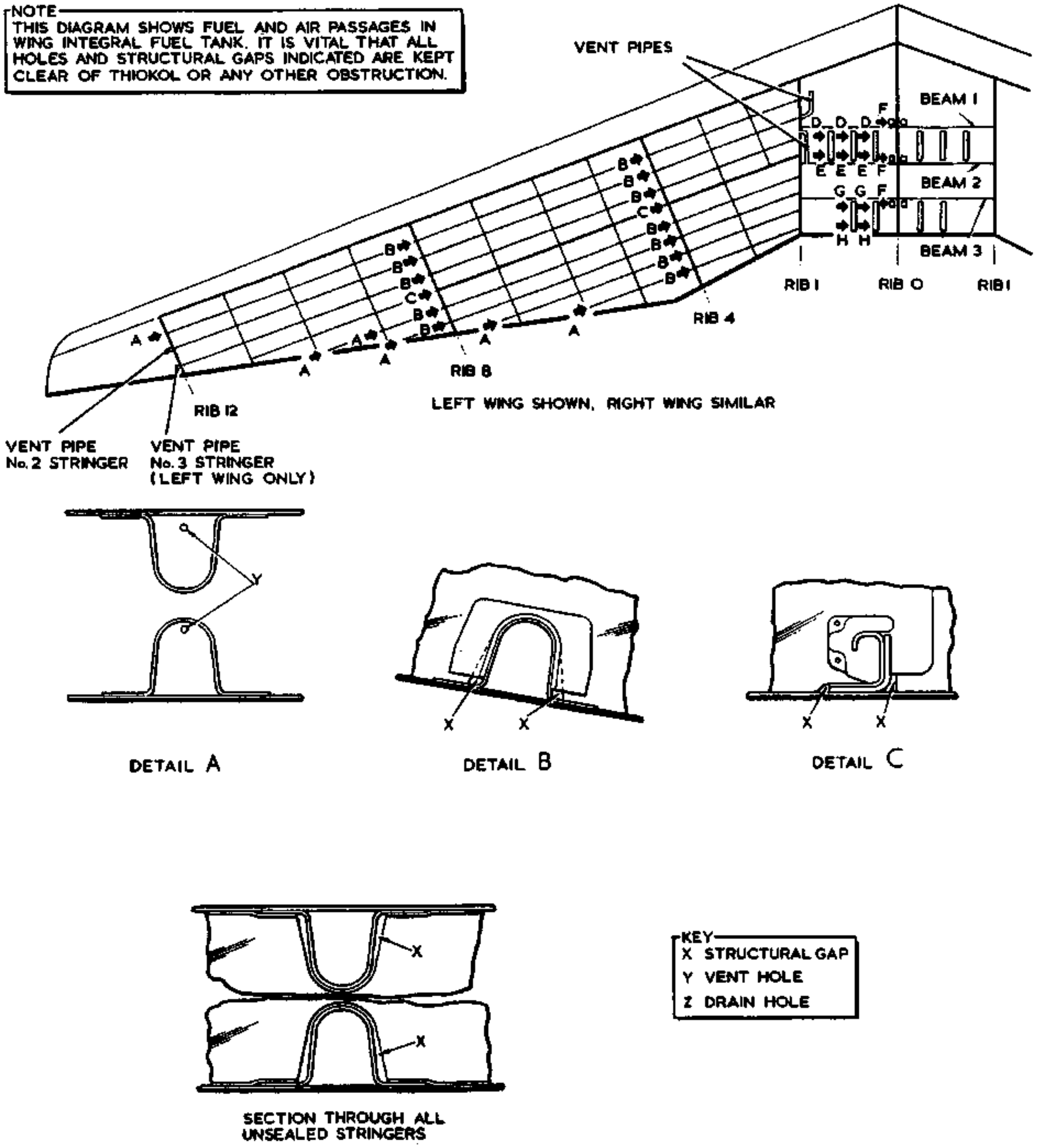
(1) Locate the leak and, use a non-metallic scraper to remove paint from around the periphery of the bolt.

(2) Refer to paragraph 1.A. Assess the leak to make sure that a temporary repair is applicable.

(3) Use a soft pencil and mark a 2 in. dia. circle on the wing skin, centered on the bolt that leaks.

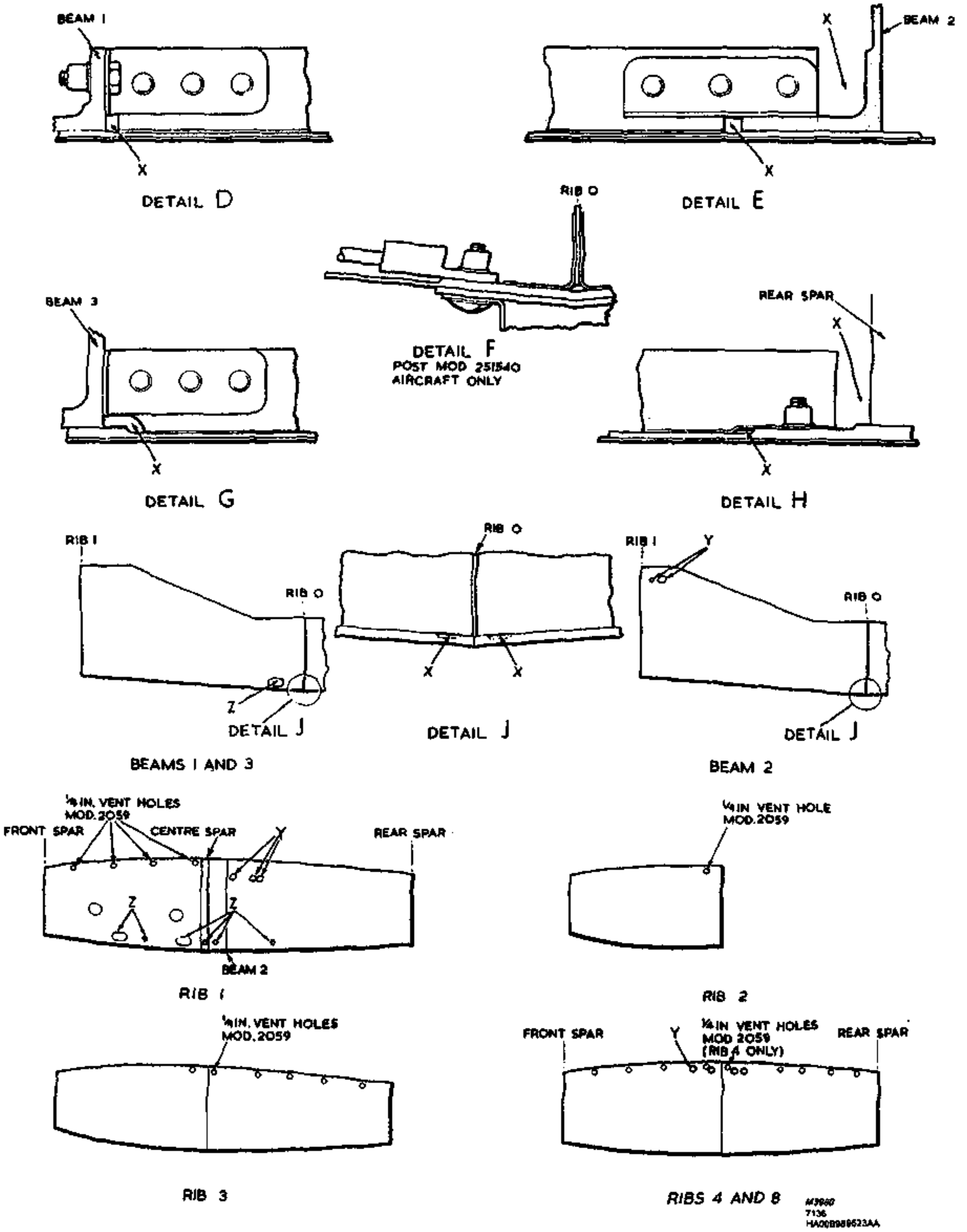
(4) Turn the pressure bolt in the body of the tool until 0.5 in. of thread is exposed in the bore of the body.

(5) Fill the exposed bore of the body with sealant (Item 316).

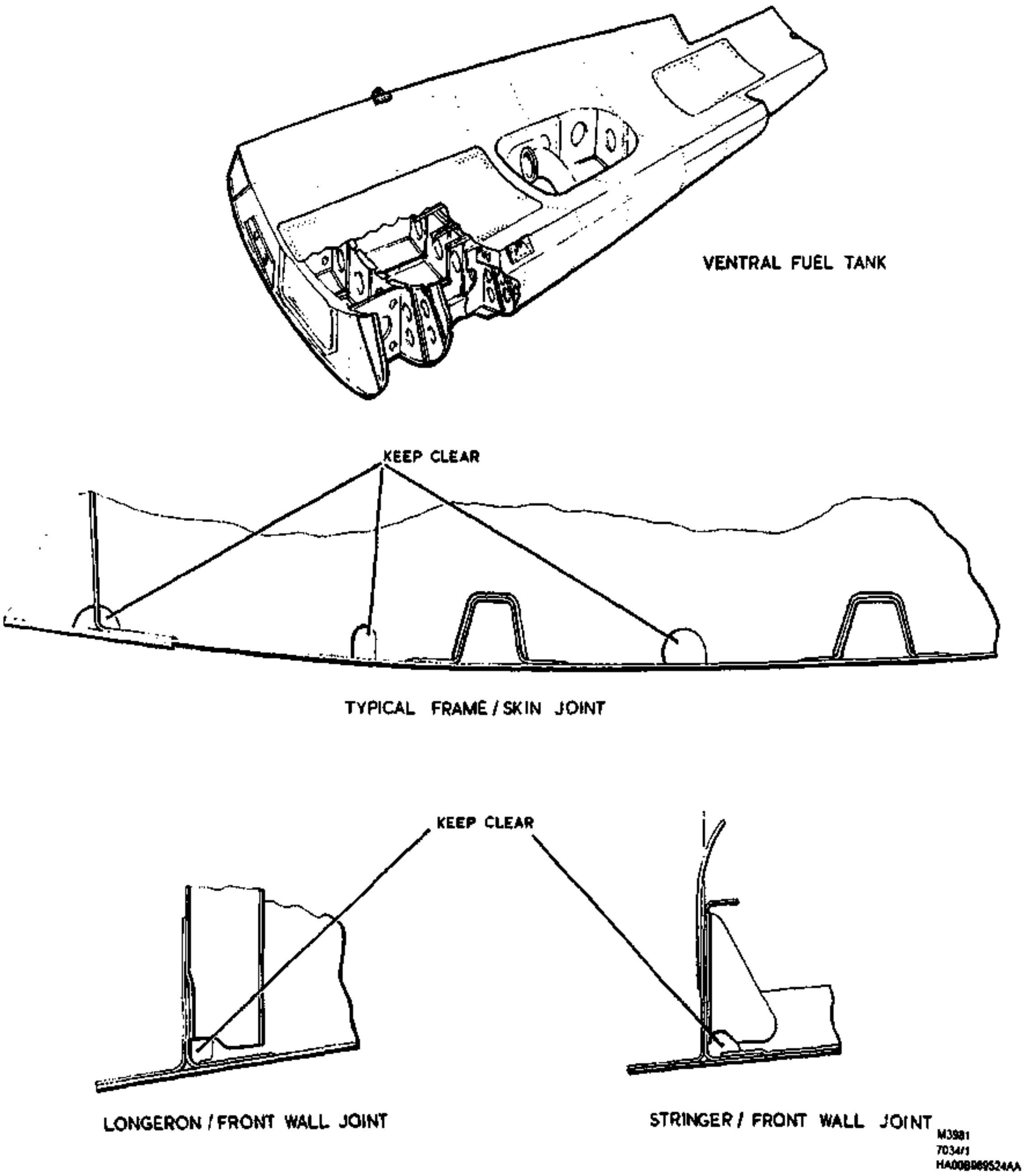

NOTE
THIS DIAGRAM SHOWS FUEL AND AIR PASSAGES IN WING INTEGRAL FUEL TANK. IT IS VITAL THAT ALL HOLES AND STRUCTURAL GAPS INDICATED ARE KEPT CLEAR OF THIOKOL OR ANY OTHER OBSTRUCTION.
VENT PIPES
BEAM 1
BEAM 2
BEAM 3
RIB 1
RIB O
RIB 1
RIB 4
RIB 8
RIB 12
A
B
C
D
E
F
G
H
LEFT WING SHOWN, RIGHT WING SIMILAR
VENT PIPE No. 2 STRINGER
VENT PIPE No. 3 STRINGER (LEFT WING ONLY)
Y
X
DETAIL A
DETAIL B
DETAIL C
SECTION THROUGH ALL UNSEALED STRINGERS
KEY
X STRUCTURAL GAP
Y VENT HOLE
Z DRAIN HOLE
M3982
5393/1
HA00B989525AA

Fuel and air passages through the wing structure

*Figure 202 (Sheet 1)*



Fuel and air passages through the wing structure
*Figure 202 (Sheet 2)*

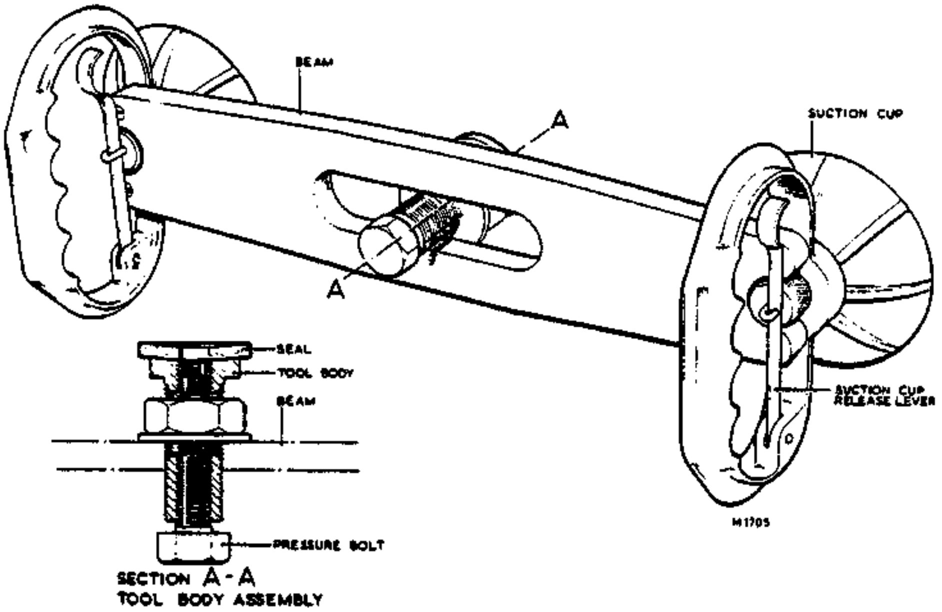

VENTRAL FUEL TANK
KEEP CLEAR
TYPICAL FRAME / SKIN JOINT
KEEP CLEAR
LONGERON / FRONT WALL JOINT
STRINGER / FRONT WALL JOINT
M3981
7034/1
HA00B989524AA

Fuel and air passages - Long range tank
*Figure 203*

*NOTE: The sealant (Item 316) may be thinned by up to 30% of its volume with cleaning agent (Item 204).*

(6) Screw the large nut up to the head of the tool body, install the washer over the body, and position the body in the slot of the beam.

(7) Offer up the complete tool assembly so that the sealant charged body aligns with the circle marked around the bolt that leaks.



Bolt sealing fixture
*Figure 204*

(8) Push assembly to wing skin, compressing the suction caps, which must be wet and located clear of the bolt heads.

(9) Finally locate the tool body over the bolt that leaks and then screw the large nut until, it abuts the beam, it is finger tight.

(10) Hold the body of the tool and, use the spanner provided to screw the large nut a further three turns to force the seal on the head of the body against the wing skin; the tool body must not turn.

(11) Screw in the pressure bolt until the sealant (Item 316) exudes from between the seal on the body and wing skin; leave for 3 minutes.

(12) Operate the levers on the handles of the suction caps, and remove the complete tool from the wing skin.

(13) Clean off surplus sealant from the wing skin, use a non-metallic scraper.

(14) Use cleaning solvent (Item 204) to remove all traces of sealant (Item 316) from the body of the tool.

### C. Temporary repair using a Click-Patch

**CAUTION: CLICK-PATCHES CAN ONLY BE USED FOR THE TEMPORARY REPAIR OF FUEL LEAKS ON THE BOTTOM SURFACES OF THE WINGS. THESE PATCHES ARE ONLY A TEMPORARY REPAIR, THE LEAK MUST BE PERMANENTLY REPAIRED WITHIN SIX MONTHS.**

| Equipment/Materials | Vendor name/address |
|---|---|
| Click-Patch | Click Bond, Inc.,<br>2151 Lockheed Way<br>Carson City<br>Nevada, 89706-0713<br>U.S.A.<br>Tele: 702 885 8000<br>Fax: 702 883 0191 |

(1) Locate the leak and, use a non-metallic scraper to remove paint from around the periphery of the rivet.

(2) Refer to paragraph 1.A. Assess the leak to make sure that a temporary repair is applicable.

(3) If the leakage is around a rivet, restrike the rivet. This can only be done once. If the leak persists, replace the rivet.

(4) An alternative method for repair of rivet leaks is to install a Click-Patch.

*NOTE: The Click-Patch is a thin aluminium disc which is applied directly over the exterior side of the leak and bonded in place with epoxy. Patches are available for flush and protruding head rivets. Because the adhesive used with these patches will cure in the presence of fuel, it is not necessary to drain the tank before patch installation.*

(5) Record the temporary repair in the airplane's technical records, stating that the repair must be made permanent within six months.

### D. Internal repairs

**CAUTION: IF ACCESS TO THE REPAIR INVOLVES THE REMOVAL OF THE WING LEADING EDGE, REFER TO THE STRUCTURAL REPAIR MANUAL.**

| Equipment/Materials | Part/Item No. |
|---|---|
| Cleaning solvent | 204 (Chapter 20-95-201) |
| Sealant | 319 (Chapter 20-95-301) |
| Synthetic rubber coating | 312 (Chapter 20-95-301) |

**WARNING: AVOID CONTACT BETWEEN SEALANT (ITEM 319) AND THE SKIN (PARTICULARLY OPEN BREAKS). DO NOT INGEST SEALANT (ITEM 319), AND WASH HANDS IMMEDIATELY AFTER USE.**

(1) Refer to paragraph 1.B. Drain the fuel tank(s) and purge of fumes.

(2) Refer to paragraph 3.A. Remove the temporary repair, if installed.

(3) Gain access to the leak through the appropriate manhole cover/access panel (MAN HOLE COVERS AND ACCESS PANELS).

**WARNING: USE EXPLOSION PROOF FLASHLIGHTS OR INSPECTION LAMPS IN TANKS.**

*NOTE: If a leak is from the long range tank, it may be possible to effect a repair through the left or right access panels in the equipment bay entry. If this is not possible, refer to paragraph 2.A. and remove the long range tank.*

(4) Use a piece of Perspex, fibreboard or hardwood to form a scraper, remove Sealant from around the leak area and extract debris with a vacuum cleaner.

(5) Thoroughly clean the whole area to be repaired with a clean cloth, moistened with Cleaning solvent (Item 204); wipe dry immediately.

*NOTE: Do this paragraph immediately before you apply the sealant (Item 319).*

(6) Prepare enough sealant (Item 319) for one application.

(a) Thoroughly stir the accelerator (part of sealant (Item 319) in its container, until you get an even consistency.

(b) Mix all the accelerator (part of sealant (Item 319) with all the base compound (part of sealant (Item 319) supplied in the kit, and stir until you get an even color.

*NOTE: Use a hand held spatula and slowly stir the accelerator (part of sealant (Item 319) into the base compound (part of sealant (Item 319).Record the time at which the mix is complete. Application life for the sealant (Item 319) is 30 minutes.*

**CAUTION: KEEP FLAP VANE SEATINGS AND MANDATORY FUEL AND AIR PASSAGES *(Figures 202, 203)* FREE OF SEALANT.**

(7) Immediately brush one continuous coat, not less than 0.030 in. thick, over the whole prepared area.

(8) Let the sealant cure for 45 mins. (from the time of mixing), then repeat paragraphs (6) and (7).

(9) After a period of 45 minutes, apply a top coat of synthetic rubber coating (Item 312) to the area, overlap the preceding application by at least 1.00 in.

**CAUTION: SEALANT (ITEM 319) IS DEPENDENT UPON ABSOLUTE COVERAGE BY THIS TOP COAT OF SYNTHETIC RUBBER COATING (ITEM 312), AND THEREFORE SCRUPULOUS CARE MUST BE TAKEN IN ITS APPLICATION AND SUBSEQUENT INSPECTION TO MAKE SURE THAT AN UNBROKEN FILM IS ATTAINED.**

(10) Clean out the tank and check for foreign objects.

(11) Install manhole covers/access panels (MAN HOLE COVERS AND ACCESS PANELS) refuel tank(s), and make sure there are no leaks.

*NOTE: If a leak has necessitated the removal of the long range tank, refer to paragraph 2.B. and install the tank.*

## MANHOLE COVERS AND ACCESS PANELS - MAINTENANCE PRACTICES

### 1. Removal/Installation (Fig. 201)

Materials required :-

| | |
|---|---|
| Grease, anti-fretting ... ... | DTD 5527 |
| Compound, jointing JC5A ... ... | DTD 900/4488 |
| Sealant, Thiokol (to DHA. 461) ... ... | DTD 900/4523 |
| Sealant, Thiokol (to DHA. 447) ... ... | DTD 900/4590 |
| Release agent ... ... ... | Grease MS. 7 |
| Cleaning fluid ... ... ... | Genklene, or other suitable non-toxic material. |

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A. Remove wing tank manhole cover

(1) Close low pressure cross-feed and transfer valves.

(2) Drain appropriate tank (see Chapter 12, FUEL).

(3) No. 1 compartment manhole cover only :-

Remove booster pump (see Chapter 28, BOOSTER PUMP).

(4) No. 2 compartment manhole cover only :-

Remove the two mushroom headed bolts from the centre of the manhole cover; retain bolts and discard the two bonded seals.

(5) Remove and retain the manhole cover attachment bolts.

(6) Remove manhole cover. Discard sealing ring.

B. Install wing tank manhole cover

(1) Ensure manhole cover seal groove is clean, apply Thiokol sealant PR. 1301 (see DHA. 461, Chapter 20) thinly to seal groove. Fit new sealing ring.

(2) Ensure that manhole wing skin seating is clean.

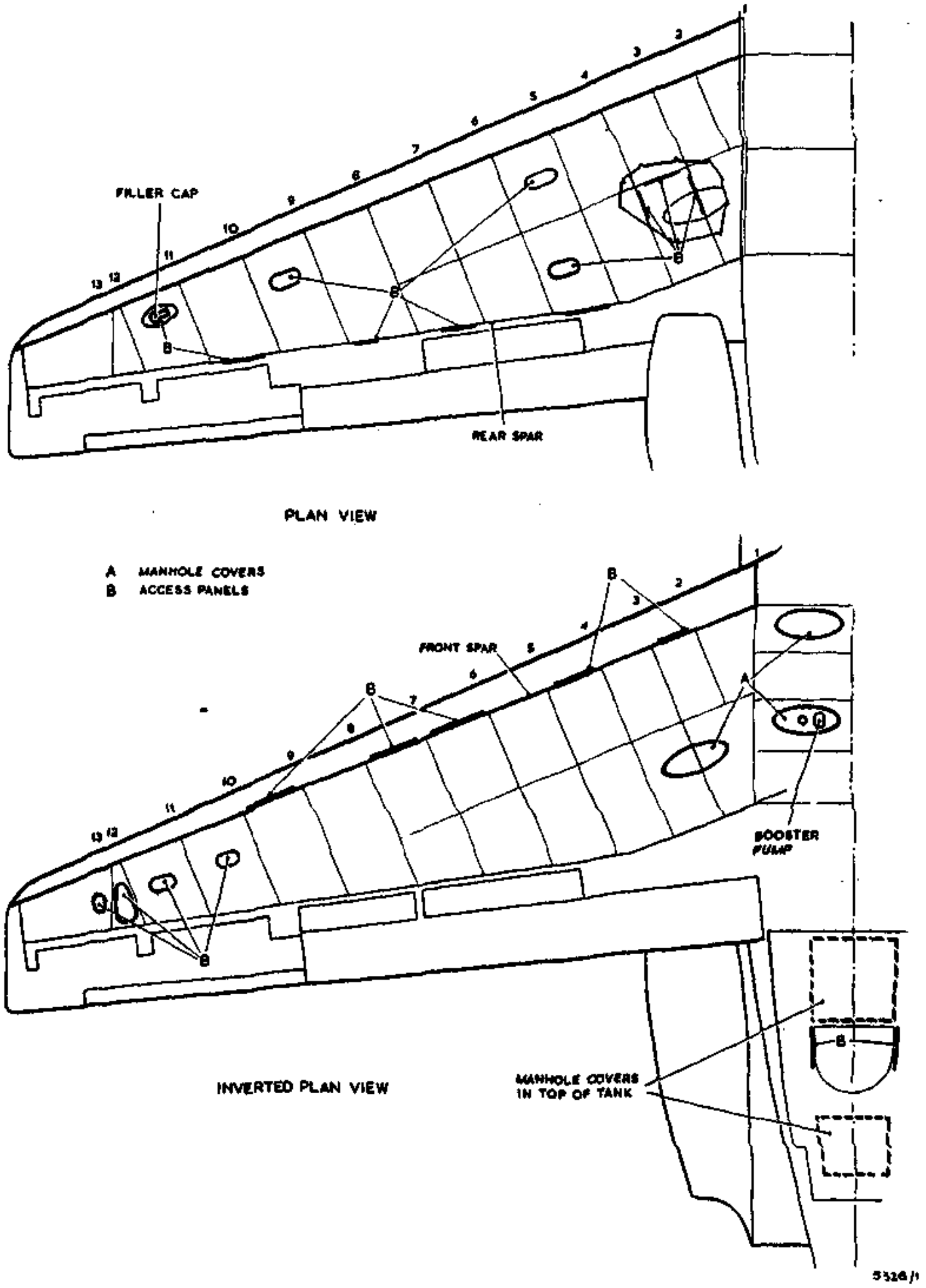
(3) Lightly lubricate retaining bolt threads with anti-fretting grease.

(4) Fit manhole cover and secure with three attachment bolts.

(5) Start other bolts and apply jointing compound to underside of bolt heads.

(6) Screw down bolts and slacken the three already fitted: apply jointing compound to underside of heads of these three.

(7) Tighten down all bolts evenly but not in rotation.



Manhole covers and access panels
Fig.201

...Manhole covers and access panels - Maintenance practices continued

(8) No. 2 compartment manhole cover only :-

Fit the two msuhroom headed bolts and new bonded seals, to secure manhole cover to rib No. 3.

(9) No. 1 compartment manhole cover only :-

Fit booster pump (see Chapter 28, BOOSTER PUMP).

(10) Refuel tank. Check manhole cover for leaks.

C. Remove long range tank manhole cover

(1) Remove long range tank (see Chapter 28, TANKS).

(2) Remove and retain manhole cover attachment bolts and washers. Carefully remove manhole cover.

(3) Using a sharpened piece of hard wood or plastic, remove old sealant from cover and tank mating face.

(4) Remove old sealant which may have entered the tank, and thoroughly clean out tank; this is best achieved using a vacuum cleaner.

D. Install long range tank manhole cover

(1) Ensure that the interior of the long range tank is thoroughly clean.

(2) Using Genklene, clean tank and manhole cover mating surfaces.

(3) Apply a thin continuous coating of Thiokol PR.1301 (see DHA.461, Chapter 20), to the manhole cover mating surface and immediately position cover on tank with bolt holes aligned. Secure manhole cover with bolts and washers, tightening bolts evenly.

NOTE : Do not tighten bolts in rotation.

(4) Fit long range fuel tank (see Chapter 28, TANKS).

E. Remove wing tank access panel

(1) Close low-pressure, cross-feed and transfer valves.

(2) Drain appropriate wing tank (see Chapter 12, FUEL).

(3) Remove access panel and retain attachment bolts.

F. Install wing tank access panel

(1) Remove old sealant from access panel sealing in wing skin. Ensure that

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tank is thoroughly clean. Finally, using Genklene, clean wing skin mating surface.

(2) If damaged, remove old sealant from access panel, clean mating surface with Genklene and apply new Thiokol seal (see DHA. 447, Chapter 20).

(3) Apply a thin coat of Thiokol PR. 1422 BT $\frac{1}{2}$ (see DHA. 461, Chapter 20), to access panel seating in wing skin.

(4) Apply a thin coat of release agent to access panel seal.

(5) Apply Thiokol under attachment bolt heads and secure access panel to wing with bolts. Tighten bolts evenly. Wipe off surplus sealant.

(6) Refuel tank and check for leaks.

G. Remove long range tank access panel

(1) Close long range tank fuel transfer valve.

(2) Defuel and drain long range tank (see Chapter 12, FUEL).

(3) Gain access to access panel, through the rear equipment bay door.

NOTE : The long range tank high level float switch is mounted on the right-hand access panel.

(4) Right-hand access panel only :-
   (a) Isolate electrical supply to float switch (see Chapter 24, GENERAL).
   (b) Disconnect float switch bonding flex.
   (c) Disconnect the electrical cables at float switch.

(5) Remove and retain attachment bolts and washers.

(6) Carefully remove access panel.

(7) Using a sharpened piece of wood or plastic clean old sealant from access panel and tank mating surfaces.

(8) Remove particles of old sealant which may have entered tank and thoroughly clean out tank; this is best achieved using a vacuum cleaner.

H. Install long range tank access panel

(1) Ensure that the interior of the long range tank is thoroughly clean.

(2) Using Genklene, clean tank and access panel mating surfaces.

(3) Apply a thin continuous coating of Thiokol PR. 1301 (see DHA. 461, Chapter 20),

to the access panel mating surface, and immediately position access panel on tank with bolt holes aligned, secure panel with bolts and washers, tightening bolts evenly.

(4) Right-hand access panel only :-

(a) Connect and secure the electrical cables to the float switch.

(b) Ensuring bonding surfaces are clean, connect and secure bonding.

(c) Restore electrical supply to float switch.

(5) Refuel tank and check for leaks.

NOTE : If a right-hand panel has been installed, check for high level float switch operation during refuelling.

* * *

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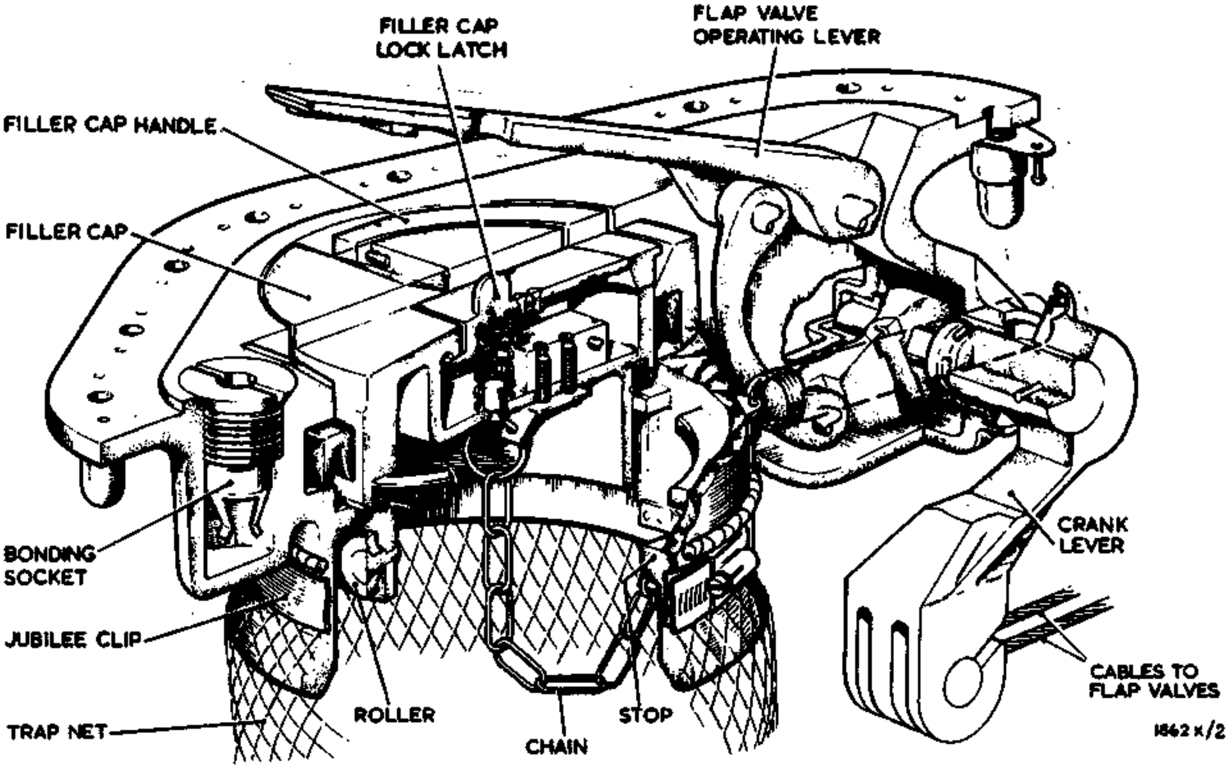
# FILLER CAP - DESCRIPTION AND OPERATION

## 1. General (Fig.1)

The filler cap assembly comprises a light alloy body and a filler cap. The cap is attached to the body by means of a retaining chain.



Filler cap assembly (pre Mod.252465)
Fig.1

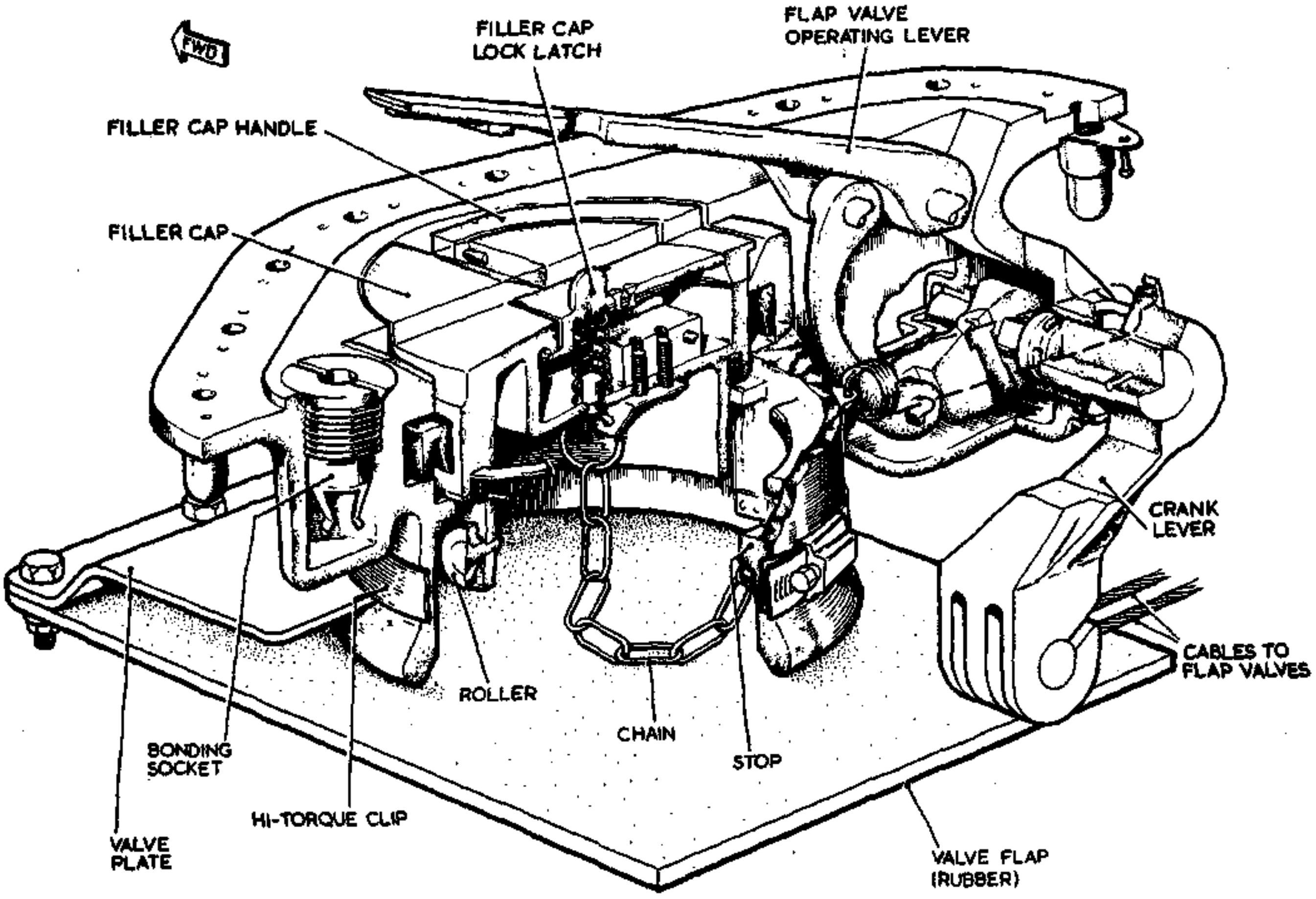
A lever (for flap valve operation), hinged on a pin in the body, fits flush across a diametral groove in the cap and locates in a small angled recess in the body.

A crank lever, on the lever, connects with a cable system to operate the flap valves in the tank. Lifting the lever to permit removal of the filler cap, will open the flap valves (see Chapter 28, FUEL - STORAGE).

A trap net, pre Mod.252465 (Fig.1), is clipped to the filler cap neck to prevent foreign bodies entering the tank but on the introduction of Mod.252465 (Fig.2), the net is deleted and a rubber flap fitted.

Fig.2 overleaf

...Filler cap - Description and operation continued



Filler cap assembly (Mod.252465)
Fig.2

* * *

# FILLER CAP ASSEMBLY - MAINTENANCE PRACTICES

## 1. Removal/Installation

Materials required :-

| | | | | |
|---|---|---|---|---|
| Anti-freeze grease | .. | .. | .. | DTD 5598 |
| Thiokol (PR.1301) | .. | .. | .. | DTD 900/4523 |

### A. Remove filler cap assembly

(1) Close low-pressure, cross-feed and transfer, valves.

(2) Drain appropriate tank (see Chapter 12, SERVICING - FUEL).

(3) Remove access panel, outboard rib No.10.

(4) Disconnect flap valve operating cables.

(5) Remove filler cap assembly.

### B. Install filler cap assembly

(1) Clean old sealant from filler cap assembly and wing structure.

(2) Apply Thiokol sealant PR.1301 in accordance with DHA 461 (see Chapter 20) to the mating surface. Fit filler cap assembly. Tighten attachment screws evenly.

NOTE : Do not tighten attachment screws in rotation.

(3) Fit and adjust flap valve control cables (see Chapter 28, FLAP VALVES).

(4) Fit access panel (see Chapter 28, MANHOLE COVER AND ACCESS PANELS).

(5) Fill cavity under filler cap lever hinge with anti-freeze grease.

(6) Ensure all drain valves are closed. Refuel tank (see Chapter 12, SERVICING - FUEL). Check for leaks.

## 2. Approved repairs

### A. Renew seal ring

(1) Remove filler cap from body. Disconnect retaining chain from filler cap.

(2) Remove damaged seal from body.

(3) Ensure seal groove is clean. Fit new seal with lips facing downward.

(4) Connect retaining chain to filler cap. Fit filler cap.

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...Filler cap assembly - Maintenance practices continued

B. Renew rubber flap valve (Mod.252465)

(1) Slacken the clip securing the rubber flap valve assembly to the filler cap neck and remove flap valve assembly.

(2) Assemble flap valve assembly, with hinge edge forward, to filler neck and tighten clip.

* * *

# FILLER CAP (VENTRAL TANK) - DESCRIPTION AND OPERATION

## 1. General

The ventral tank filler cap, (Fig.1), provides a fueltight seal to the gravity refuelling filler point and is accessible through a hinged door on the right side of the tank, aft of the rear equipment bay door.

The cap is opened by lifting the cap handle from its recess and turning it clockwise to the extent of possible rotation; the cap can then be lifted clear of its adapter neck but is held captive to the tank by a retaining chain.

To fit the cap, seat it in the adapter neck, turn the handle clockwise to the extent of its rotation and then push it back into its recess. The action of turning the handle causes triplicated locking pawls to extend from the cap and lock under an internally rebated flange in the adapter, centring and locating the cap in situ. Closing the handle down into its recess pulls the bottom plate up against the pawls with the reacting force drawing the cap top plate down onto the adapter seat where the cap O-ring makes a fuel-tight seal.

The rotational position of the cap in the adapter is immaterial. A bracket attached to the inside of the filler point access door makes it impossible to close the door without the filler cap being at least in situ in the adapter.

Fig.1 overleaf

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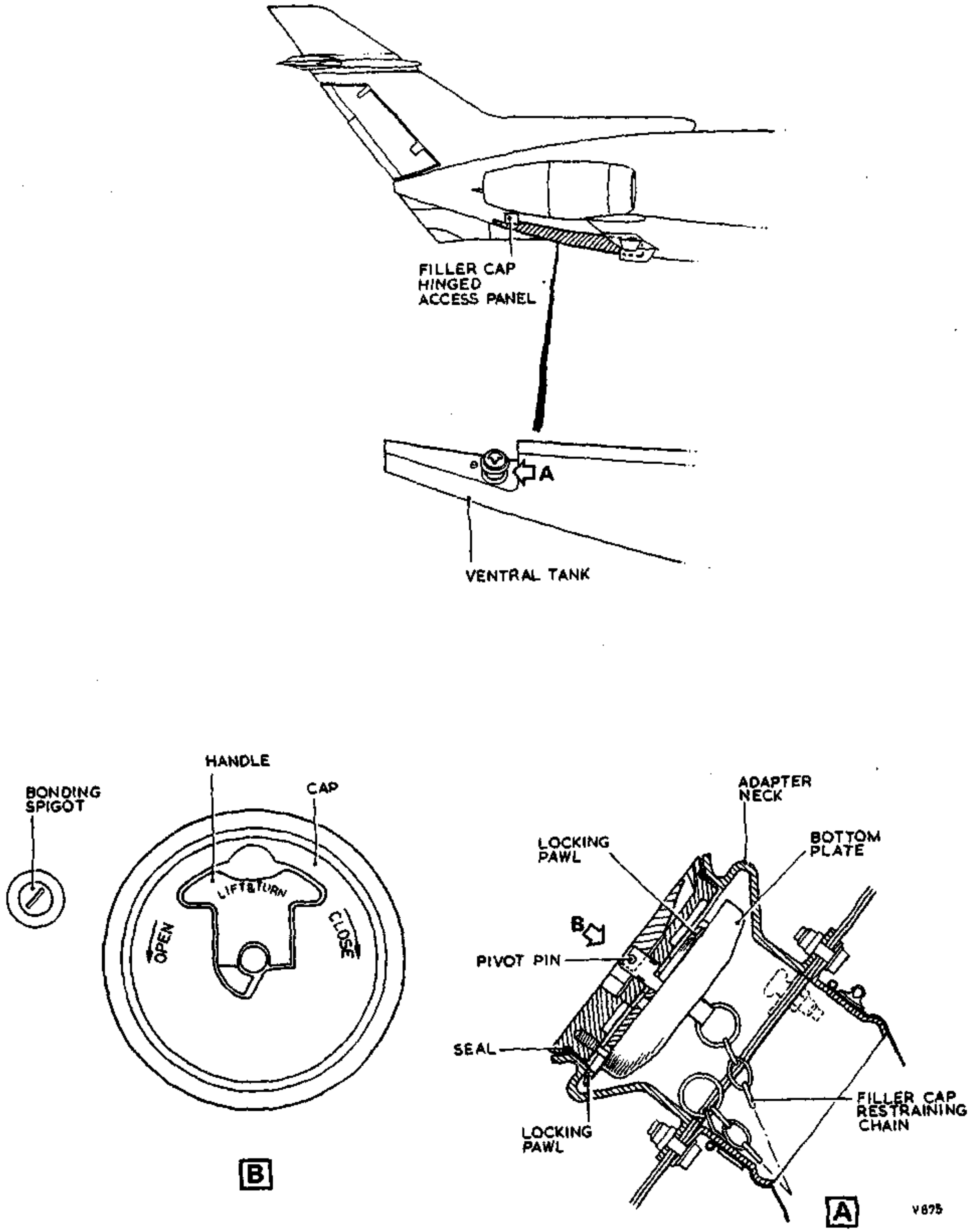

Ventral tank filler cap
Fig.1

* * *

## FLAP VALVES - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove flap valve assembly

NOTE : The valve body and valve flap are a matched pair and should be treated as an assembly.

(1) Close low-pressure, cross-feed and transfer valves.

(2) Drain appropriate fuel tank (see Chapter 12, SERVICING FUEL).

(3) Remove appropriate access panels (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(4) Disconnect valve operating cable(s).

(5) Remove flap valve assembly.

#### B. Install flap valve assembly

(1) Fit flap valve assembly. Tighten securing nuts evenly.

(2) Fit valve operating cable(s).

(3) With filler cap lever in the shut position, adjust cable to give 0.1 inch linear slack in cable run with flap valves in the closed position.

(4) Lift flap valve operating lever to the open position. Check that the flap valve stop face is clear of the wing structure.

(5) Check cable adjusters are in safety. Tighten lock nuts and wire-lock cable adjusters.

(6) Fit access panels (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(7) Ensure all drain valves are closed. Refuel tank (see Chapter 12, SERVICING-FUEL). Check for leaks.

* * *

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# FUEL DRAIN VALVES - MAINTENANCE PRACTICES

## 1. Removal/Installation

Materials required :-

| | | | |
|---|---|---|---|
| Thiokol PR.1301 | ... | ... | DTD.900/4523 |
| Thiokol PR.1422 BT | ... | ... | DTD.900/4590 |
| Cleaning fluid | ... | ... | Genklene, or other suitable non-toxic fluid |

### A. Remove wing tank fuel drain valve

(1) Close low-pressure, cross-feed and transfer valves.

(2) Drain appropriate fuel tank (see Chapter 12, SERVICING-FUEL).

(3) Remove booster pump (see Chapter 28, BOOSTER PUMP).

(4) Remove manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(5) Remove fuel drain valve.

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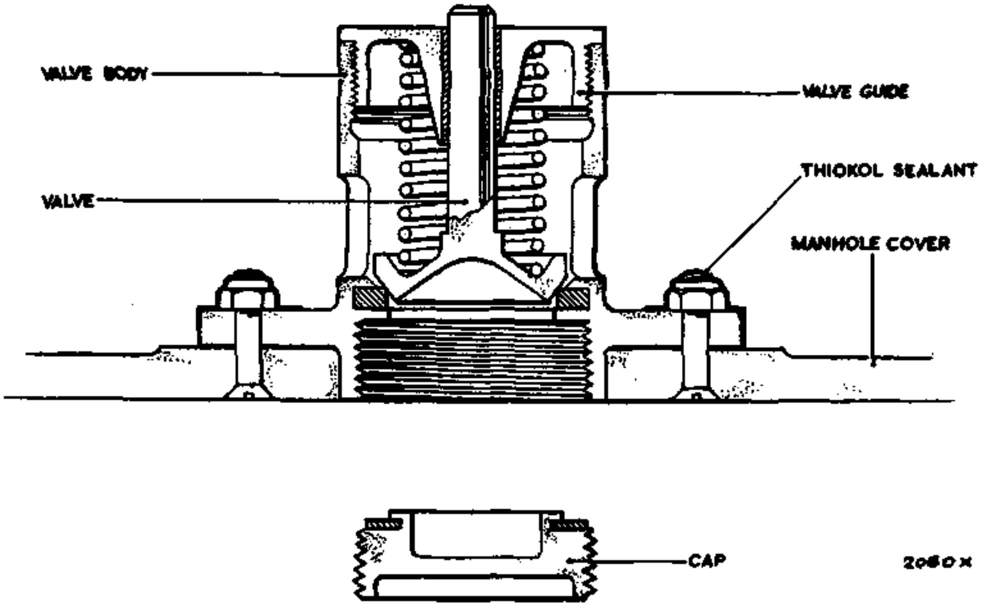

Fuel drain valve
Fig.201

B. Install wing tank fuel drain valve

(1) Clean Thiokol sealant from manhole cover and valve.

(2) Apply Thiokol PR.1301 sealant in accordance with DHA.461 (see Chapter 20), to valve and manhole cover mating surfaces and under bolt heads.

(3) Fit fuel drain valve.

(4) Holding bolt heads with a screwdriver, tighten attachment nuts evenly.

(5) Coat attachment nuts and valve flange with Thiokol PR.1422 BT 1/2 sealant in accordance with DHA.461 (see Chapter 20).

(6) Fit manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(7) Fit booster pump (see Chapter 28, BOOSTER PUMP).

(8) Ensure all drain valves are closed. Refuel tank (see Chapter 12, SERVICING - FUEL). Check for leaks.

C. Remove ventral tank fuel drain valve

(1) Remove ventral fuel tank (see Chapter 28, TANKS).

(2) Remove the ventral tank top forward manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(3) Remove the fuel drain valve; retain nuts, and packing pieces.

(4) Clean old sealant from fuel drain valve seating at base of tank and from the packing piece.

(5) Remove pieces of old sealant from tank and thoroughly clean tank. This is best achieved using a vacuum cleaner.

D. Install ventral tank fuel drain valve

(1) Thoroughly clean packing piece, fuel drain valve seating on base of tank and replacement fuel drain valve flange.

(2) Apply a coating of Thiokol PR.1301 in accordance with DHA.461 (see Chapter 20) to both sides of packing piece, fuel drain valve seating at base of tank, and to fuel drain valve mounting flange.

(3) Fit packing piece and fuel drain valve to base of tank, with nuts and bolts; coat under head and shank of bolt with Thiokol PR.1301 before assembly.

(4) Overcoat fuel drain valve flange and nuts with Thiokol sealant PR.1422 in accordance with DHA.461 (see Chapter 20).

...Fuel drain valves - Maintenance practices continued

(5) Allow Thiokol sealant to cure.

(6) Ensure tank is clean, fit top forward manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(7) Install ventral fuel tank (see Chapter 28, TANKS).

(8) Refuel tank (see Chapter 12, SERVICING-FUEL) and check for leaks.

* * *

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## WATER DRAIN VALVES - MAINTENANCE PRACTICES

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### 1. Removal/Installation

Materials required :-

| | | | |
|---|---|---|---|
| Thiokol PR.1301 | ... | ... | DTD.900/4523 |
| Thiokol PR.1422 BT | ... | ... | DTD 900/4590 |
| Cleaning fluid | ... | ... | Genklene, or other suitable non-toxic fluid. |

#### A. Remove wing tank water drain valve

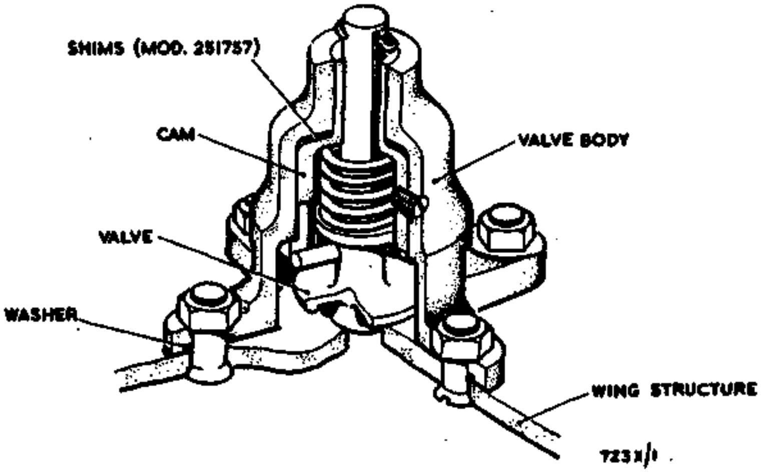
(1) Close low-pressure, cross-feed and transfer valves.

(2) Drain appropriate fuel tank (see Chapter 12, SERVICING-FUEL).

(3) Remove booster pump assembly (see Chapter 28, BOOSTER PUMP).

(4) Remove manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(5) Remove water drain valve. Retain the nuts and bolts.



Water drain valve
Fig.201

B. Install wing tank water drain valve

(1) Clean old sealant from bolt holes in wing skin.

(2) Ensure wing skin and valve flange are clean.

(3) Fit washer drain valve, sealing attachment bolts with Thiokol PR1301 sealant in accordance with DHA.461 (see Chapter 20) under bolt heads only. Holding bolt heads with a screwdriver, tighten securing nuts evenly.

NOTE : Ensure that no Thiokol gets onto mating surfaces of valve and wing skin or valve seat.

(4) Fit manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(5) Fit booster pump (see Chapter 28, BOOSTER PUMP).

(6) Ensure all drain valves are closed. Refuel tank (see Chapter 12, SERVICING-FUEL). Check for leaks.

C. Remove ventral tank water drain valve

(1) Remove ventral tank (see Chapter 28, TANKS).

(2) Remove the ventral tank top forward manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(3) Remove the water drain valve, retain nuts and bolts.

(4) Clean old sealant from water drain valve seating and bolt holes in tank skin.

(5) Remove pieces of old sealant and thoroughly clean tank. This is best achieved using a vacuum cleaner.

D. Install ventral tank water drain valve

(1) Thoroughly clean the water drain valve seating at base of tank and the replacement water drain valve attachment flanges.

(2) Apply a coating of Thiokol PR.1301 in accordance with DHA.461 (see Chapter 20) to the water drain valve flanges and fit water drain valve to its seating using the nuts and bolts; coat under head, and shank of bolts with Thiokol before assembly. Ensure that Thiokol does not come into contact with valve or valve seating.

(3) Overcoat water drain valve flange and nuts with Thiokol PR.1422 sealant in accordance with DHA.461 (see Chapter 20).

(4) Allow Thiokol sealant to cure.

...Water drain valves - Maintenance practices continued

(5) Ensure tank is clean, fit top forward manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(6) Install ventral fuel tank (see Chapter 28 TANKS).

(7) Refuel tank (see Chapter 12, SERVICING-FUEL) and check for leaks.

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# VENT FLOAT VALVE (WING TANKS) - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove vent float valve

(1) Close low-pressure, cross-feed and transfer valves.

(2) Ensure that appropriate fuel tank is not more than half full.

(3) Drain vent surge tank.

(4) Remove vent surge tank inspection door (see Chapter 28, VENT SURGE TANK).

(5) Remove bolts securing vent float valve to rib 12.

(6) Remove vent float valve. Discard O-ring seal.

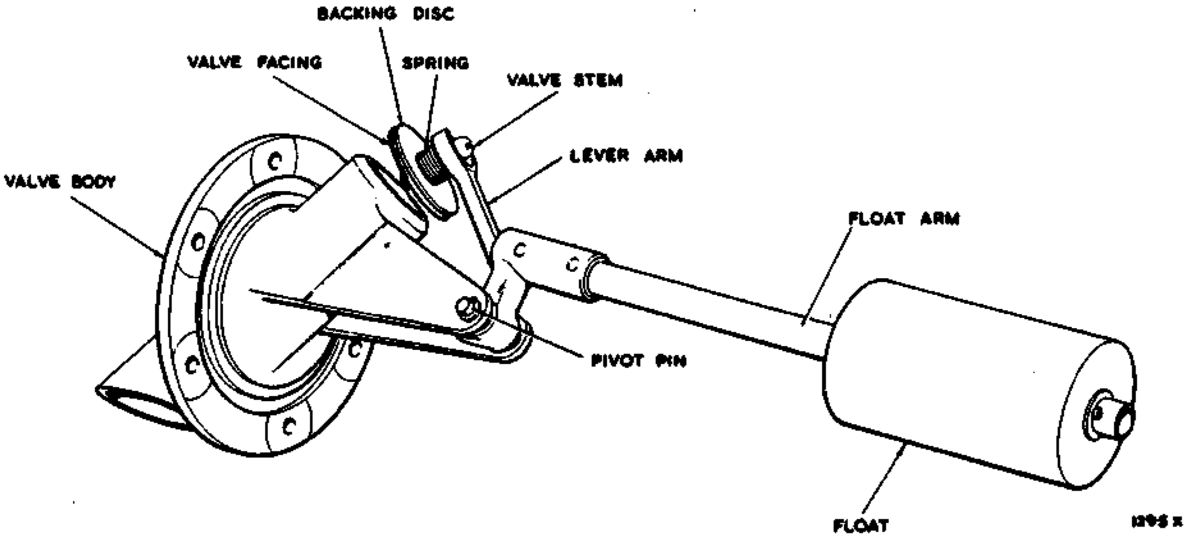
### B. Install vent float valve

(1) Ensure seal groove in vent float valve is clean. Fit new O-ring seal.

(2) Fit vent float valve. Tighten attachment bolts evenly.

(3) Ensure all drain valves are closed. Refuel tank (see Chapter 12, SERVICING - FUEL). Check for leaks.

(4) Fit vent surge tank inspection door (see Chapter 28, VENT SURGE TANK).



Wing tank vent float valve
Fig.201

* * *

# VENT FLOAT VALVE (VENTRAL TANK) - MAINTENANCE PRACTICES

## 1. Removal/Installation

Materials required :

| | |
|---|---|
| Thiokol PR 1301 .. .. .. .. .. | DTD 900/4523 |
| Cleaning fluid .. .. .. .. .. | Genklene, or any suitable non-toxic fluid |

### A. Remove vent float valve - ventral tank

(1) Remove the ventral tank (see Chapter 28, TANKS).

(2) Remove the forward manhole cover at the top of the tank (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(3) Purge tank of fuel fumes (see Chapter 28, TANKS).

(4) Inside the tank, disconnect the T-vent pipe flange from the vent float valve flange; retain the nuts, bolts and washers.

(5) Left-hand vent float valve only : At the front outside wall of the tank, remove and retain the six bolts, locking tab, bonding tab, washers and pipe adapter.

(6) Right-hand vent float valve only : At the front outside wall of the tank, remove and retain the six bolts, washers and blanking plate.

(7) Remove the vent float valve; support the T-vent pipe when breaking the Thiokol sealed joint between the T-vent pipe and float valve flanges.

(8) Using a sharpened piece of hard wood or Perspex, scrape the old sealant from the T-vent pipe flange, the float valve and adapter or blank mounting faces, on the front wall of the tank.

(9) Remove all pieces of old sealant and thoroughly clean out the tank . This is best achieved by using a vacuum cleaner.

NOTE : If a replacement vent float is not immediately available fit manhole cover and blank-off the vent float valve mounting aperture.

### B. Install vent float valve - ventral tank

(1) Remove ventral tank top forward manhole cover and blank from vent float valve aperture, if fitted.

(2) Ensure that the replacement vent float valve flanges have all traces of old sealant removed.

(3) Thoroughly clean the vent float valve and T-vent pipe flanges, blank or adapter, and the front and rear of the forward tank wall, in the vicinity of the float valve aperture.

...Vent float valve (ventral tank) - Maintenance practices continued

(4) Apply a coating of Thiokol PR 1301 sealant in accordance with DHA 461 (see Chapter 20) to the vent float valve flanges, the mating face of the pipe adapter or blank, the shank and under the head of attachment bolts.

NOTE : Ensure that no Thiokol enters the vent pipe bore.

(5) Position vent float valve in tank and align attachment holes, with holes in tank wall. Fit the adapter (left-hand float valve) or blank (right-hand float valve) and secure with the six bolts and washers.

On left hand vent float valve only ensure that the locking tab is located under the head of the bottom outboard bolt, and the bonding tag under the top outboard bolt.

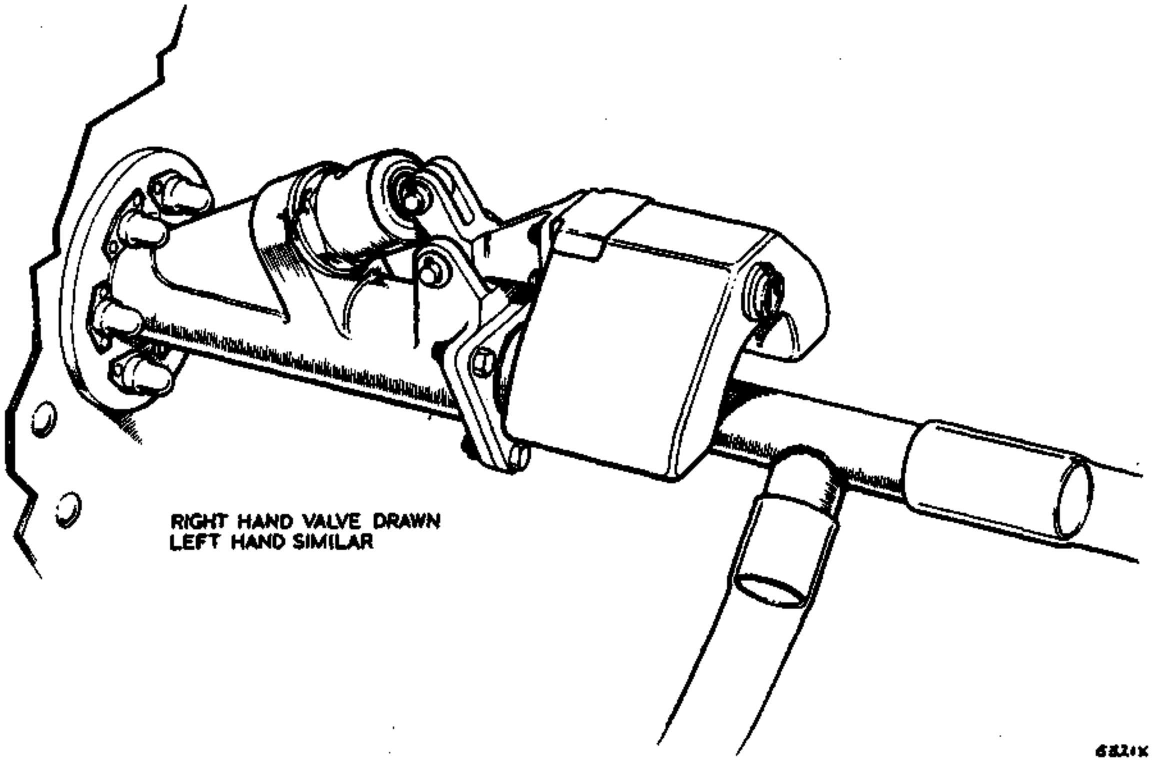
(6) Connect the vent float valve and T-vent pipe flanges, using the three nuts washers and bolts.

(7) Allow time for the Thiokol sealant to cure.

(8) Remove Thiokol 'spar' from inside vent pipe at vent valve flange.

(9) Pressure and flow test tank venting system (see Chapter 28, TANKS).

(10) Install ventral tank (see Chapter 28, TANKS).



Ventral tank vent float valve
Fig.201

* * *

## VENT SURGE TANK - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove inspection door

(1) Drain vent surge tank.

(2) Remove inspection door securing bolts. Remove inspection door.

#### B. Install inspection door

Materials required :-

| | |
|---|---|
| Thiokol .. .. .. .. | DTD 900/4590 |
| Release agent .. .. .. | MS7 grease |

(1) If damaged, clean old sealant from inspection door, apply new Thiokol seal to DHA 447 (see Chapter 20).

(2) Apply a thin coat of release agent to mating surface of wing structure.

(3) Fit inspection door. Tighten attachment bolts evenly.

NOTE : Do not tighten bolts in rotation.

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# DRAIN VALVE - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove drain valve

(1) Drain vent surge tank.

(2) Remove vent surge tank inspection door (see Chapter 28, VENT SURGE TANK).

(3) Remove drain valve.

### B. Install drain valve

Materials required

| | | | |
|---|---|---|---|
| Thiokol PR 1301 | .. | .. | DTD 900/4523 |

(1) Clean old sealant from bolt holes.

(2) Fit drain valve with Thiokol under bolt heads only. Holding bolt heads with a screwdriver, tighten securing nuts evenly.

NOTE : Ensure that no Thiokol gets onto mating surfaces of valve and wing skin or valve seat.

(3) Fit vent surge tank inspection door (see Chapter 28, VENT SURGE TANK).

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## Non-return valve (Long range tank) F.R. 9811475 Maintenance Practices

1. Removal/Installation (Fig.201)

A. Remove long range tank non-return valve

(1) Defuel the long range tank (see Chapter 12, SERVICING - FUEL).

(2) Remove the long range tank from the aircraft (see Chapter 28, TANKS).

(3) Remove the long range tank rear manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

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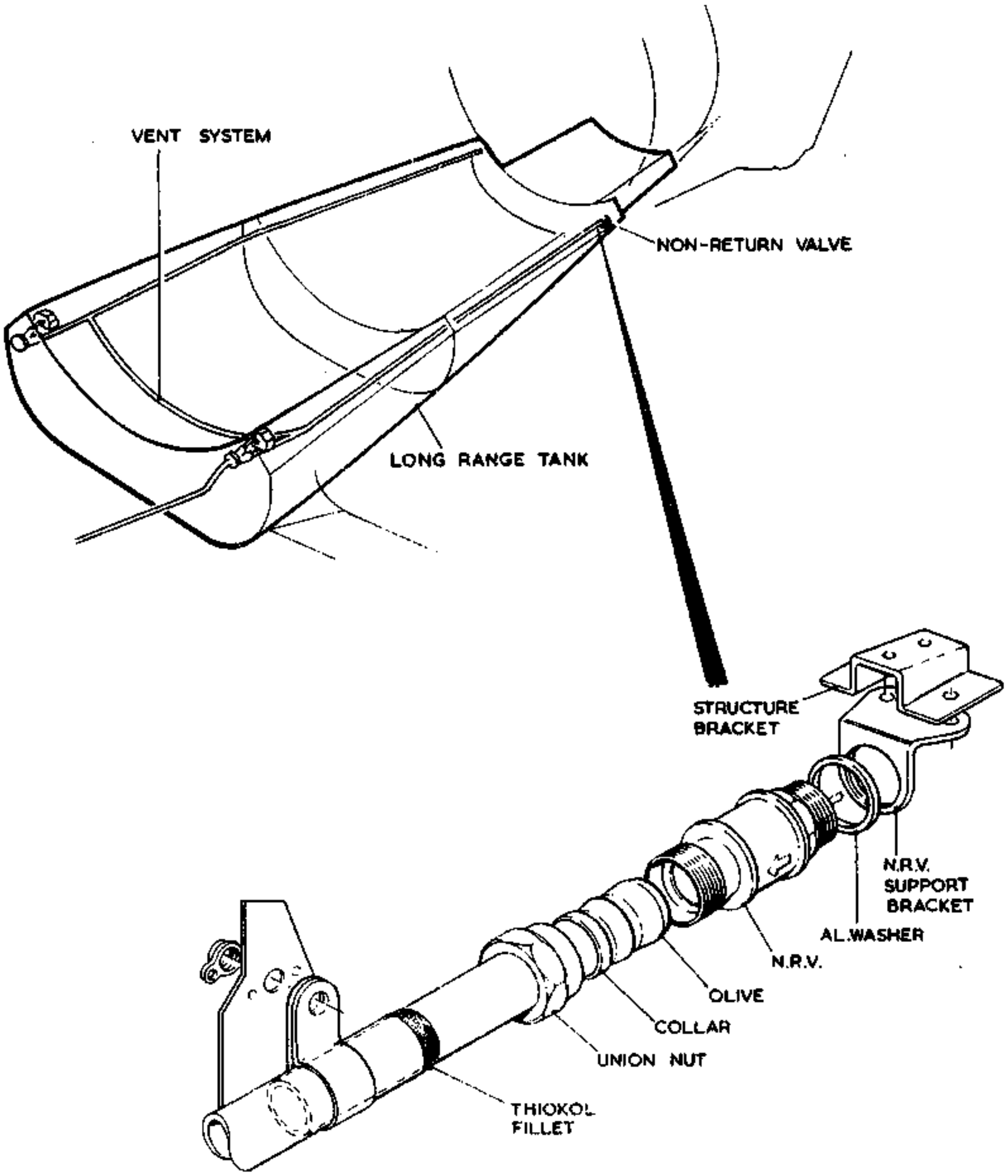

Long range tank non-return valve installation
Fig.201

...Non-return valve maintenance practices continued

(4) Invert the long range tank, or trestle on its side, to obtain comfortable access to the non-return valve.

(5) Remove the two hexagon headed bolts, washers and locknuts, securing the non-return valve support bracket to the tank structure bracket.

(6) Unscrew the valve union nut and remove the valve complete with support bracket. Remove the olive from the vent pipe.

(7) Unscrew the non-return valve from the support bracket. Retain the aluminium seal washer.

B. Install long range tank non-return valve

(1) Ensure that the non-return valve is free of corrosion, not damaged, the thread serviceable with legibility of flow direction arrow. Actuate spindle several times in quick succession to check valve for free movement.

(2) Fit the aluminium jointing washer on inlet end (spindle end) of the non-return valve and screw inlet end of the valve into the support bracket sufficient to pinch the washer.

(3) Fit the pipe olive in the bell-end of the vent pipe. Locate the outlet end of the valve onto the vent pipe and olive and screw up the union nut on the valve but do not tighten.

(4) Turn the valve, complete with support bracket, to line up the support bracket attachment holes with the mating holes in the structure bracket.

(5) Assemble the support bracket to the structure bracket with the two hexagon headed bolts, washers and locknuts.

(6) Tighten up the union nut and wire-lock.

(7) Check that the radial Thiokol fillet around the telescoped joint of the pipe is undamaged. If the Thiokol fillet has been disturbed, clean away the old and apply a fresh Thiokol 1422-2 fillet in accordance with DHA.461 (see Chapter 20).

(8) Flow test the long range tank vent system (see Chapter 28, STORAGE).

(9) Fit tank manhole covers (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(10) Install the long range tank to the aircraft (see Chapter 28, TANKS).

* * *

# FUEL FEED SYSTEM (MAIN ENGINES) - DESCRIPTION AND OPERATION

## 1. General (Fig.1)

The fuel feed system is that part of the fuel system concerned with the delivery of fuel from the aircraft tanks to the engine fuel system disconnect point.

The feed system is basically similar for both engines except that the supply line to the left engine also provides a supply to the auxiliary power plant (if fitted).

A booster pump, housed in a reservoir in the inboard section of each wing tank, normally supplies fuel via a low pressure valve (cock) to its respective engine.

A crossfeed valve permits either booster pump to feed either or both engines in the event of a pump malfunction or engine failure and a transfer valve permits the transfer of fuel between the wing tanks to maintain fuel balance during crossfeeding. A long range tank valve allows fuel to be transferred from the ventral (long range) tank to the wing tanks.

In the event of failure of both booster pumps the engines may be operated on suction feed.

The booster pumps are each powered from separate busbars during normal operation but they may also be powered from the emergency busbar.

## 2. Wing tank feed system (Fig.1)

In addition to pumping fuel to the respective engines, the fuel booster pump in the number 1 compartment of each wing tank also pumps fuel to two jet pumps; one jet pump drains fuel from the wing tank manifold stringers and maintains the booster pump reservoir full, so ensuring that supplies are maintained to the pump during momentary negative G conditions. The other jet pump forms part of the fuel transfer system and induces a fuel flow into its respective wing tank reservoir from either the opposite wing tank or the ventral tank.

The transfer system jet pumps also operate a scavenge system which continuously transfers fuel from between the beams of the centre section to the booster pump reservoir, thereby ensuring that water does not accumulate in an undrainable location.

Non-return valves are fitted to the various pipes and sides of the booster pump reservoirs to ensure that the general direction of fuel flow is from the tanks to the reservoir. A non-return valve in the feed line of each engine ensures that, during crossfeeding, fuel is not transferred to the opposite wing tank. The non-return valve, in the engine suction feed line has a strainer to protect its inlet.

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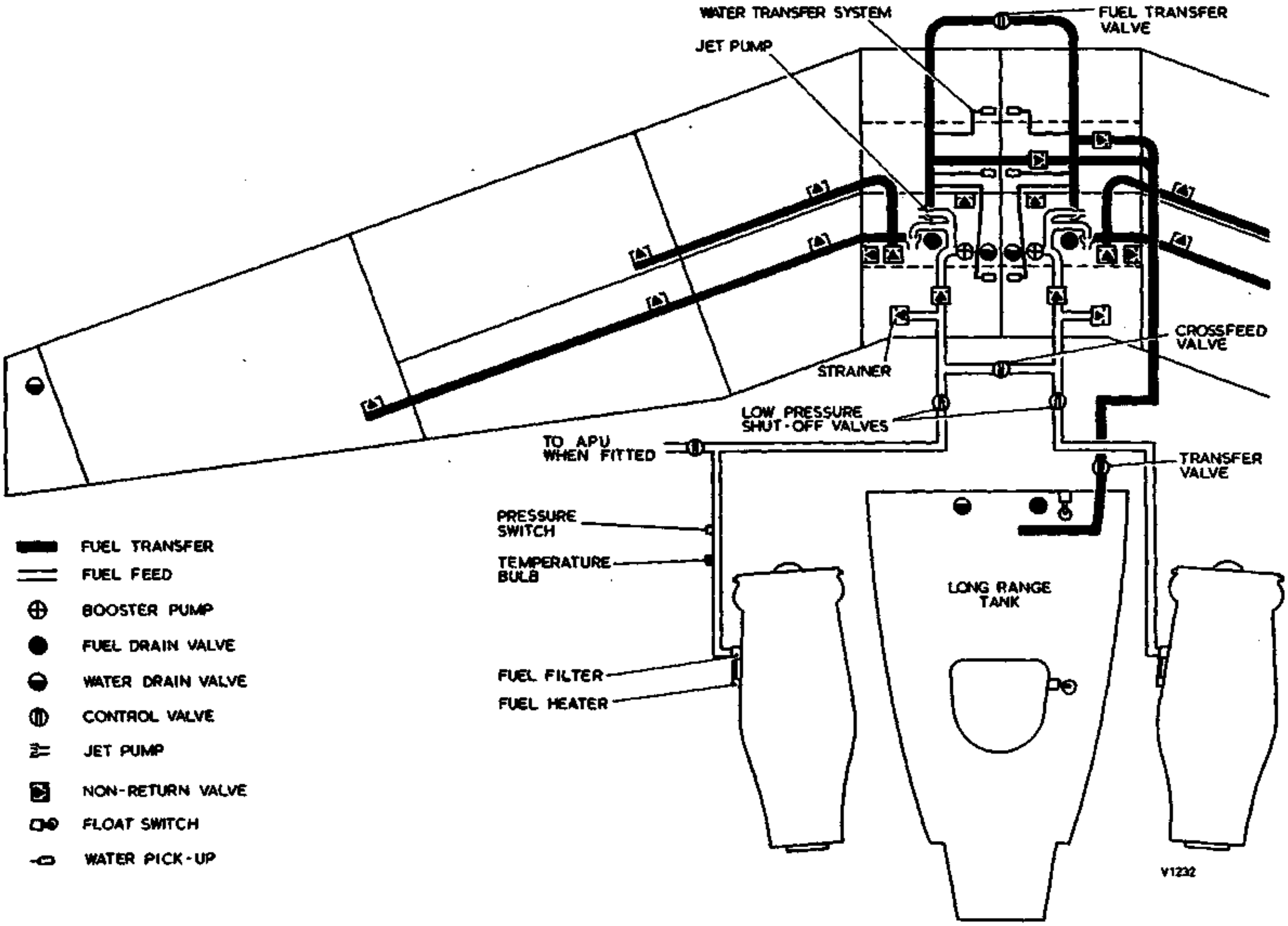

Fuel feed system
Fig.1

...Fuel feed system continued

## 3. Ventral (long range) tank fuel transfer system

With both wing tank booster pumps running, transfer takes approximately 5 to 6 minutes. With only one booster pump running transfer of fuel to its respective wing tank may increase to over 12 minutes.

If both booster pumps fail it is not possible to transfer fuel from the long range tank to the wing tanks.

## 4. Fuel valve controls and position indicating systems

### A. General (Fig.1 and 2)

Two LP COCKS levers, a LONG RANGE TANK COCK lever and a single X FEED/TRANSFER lever (all on the pilots central control pedestal) are each connected to their respective valve by a cable control run. Each lever moves within a gated quadrant and before a selection can be made the knob on each lever must be pulled out against spring pressure; releasing the knob locks the lever in the selected position.

NOTE: For examination and rejection criteria on control cables (see Chapter 20, CONTROL CABLES - EXAMINATION AND REJECTION CRITERIA).

### B. Low pressure fuel valve (cock)

Each engine low pressure valve (cock) is opened when the associated LP COCKS lever is moved up to the open position. A hinged guard, fitted forward of the control levers, must be lifted before the levers can be moved down to the shut position.

### C. Ventral (long range) transfer valve

The ventral tank valve is operated by a single LONG RANGE TANK COCK lever which has a hinged guard fitted over the lever holding it up in the shut position. Lifting the guard and moving the lever down to the transfer position opens the transfer valve and also operates a microswitch which illuminates an indicator lamp in the flight compartment roof panel.

### D. Wing tank crossfeed and transfer valves

The wing tank crossfeed valve and the transfer valve are both operated by a single X FEED/TRANSFER lever. When the lever is up, in the WING FUEL position, both the crossfeed and transfer valves are closed and fuel is fed from the left tank to the left engine (No.1) and from the right tank to the right engine (No.2).

When the lever is moved down to the centre gate "X FEED" position the crossfeed valve is opened and fuel from either tank can be fed to one or both engines; further movement downwards of the lever to the TRANSFER position opens the wing transfer valve so that both the crossfeed and

...Fuel feed system continued

transfer valves are now open. The lever in this position also operates a microswitch which operates an OPEN/SHUT magnetic indicator (on the right-hand main instrument panel) to OPEN. With TRANSFER selected and a single booster pump operating, fuel is transferred from the opposite wing tank to that containing the operating pump.

## 5. Electrically-operated controls and normal operation indicating systems (Fig.2)

### A. Booster pumps control

Booster pumps are each controlled by a L and R PUMP ON-OFF-EMERG switch.

### B. Fuel flow

Fuel flow to each engine is registered by a flowmeter indicator calibrated in LBx100 which shows the instantaneous rate of flow.

A fuel flowmeter transmitter is fitted on each engine.

### C. Wing tank fuel contents

The fuel contents of each wing tank is shown by an indicator calibrated in LBx1000. The maximum indicating errors, in pounds, are with tank empty ± 50 lb., tank ¼ full $^{+160}_{-200}$, tank ½ full $^{+120}_{-180}$, tank full ±180.

Six capacitance type transmitters are fitted in each wing tank.

### D. Ventral (long range) tank contents

Contents of the ventral tank is shown by a magnetic indicator, AUX CONTENTS, which displays FULL or EMPTY, as appropriate, or 'cross hatched' at an intermediate fuel state and with electrical power off.

Two float switches, a high level and a low level, are fitted in the ventral tank.

When the tank becomes empty during flight, the low level float switch disconnects the power supply to the low speed part of the Mach/airspeed audible warning system.

### E. Fuel temperature (From tanks) (Fig.2)

Fuel temperature is shown by a WING FUEL temperature indicator, calibrated from -60°C to +60°C, a fuel temperature bulb being fitted in the No.1 engine fuel supply line.

...Fuel feed system continued

## 6. Fuel system malfunction warning systems (Fig.2)

### A. Fuel low pressure warning

Loss of fuel pressure, as sensed by a pressure switch at each engine fuel pump inlet, is indicated by annunciators ENG 1 or 2 LO PRESS and also the annunciator FUEL on the centre main panel.

Each engine mounted pressure switch is set at 3.0 ± 0.5 lb/sq.in.

### B. Fuel overheat warning

Excessive fuel temperature, as sensed by a temperature switch in each engine fuel pump assembly, is indicated by FUEL 1 or 2 O/HEAT annunciators in the roof panel.

Each engine mounted switch is set to operate at 87.8 ± 2.8°C on a rising temperature; the switch de-actuates at 65.6°C on a falling temperature.

### C. Fuel filter blocked

Blockage of a low pressure fuel filter, as sensed by a differential pressure switch housed in each fuel pump assembly, is indicated by annunciators FUEL 1 or 2 FILTER in the centre main panel.

Each engine-mounted switch is set to operate between 6 to 8 lb/sq.in. differential.

Whenever a filter is blocked a by-pass valve will open, automatically, to allow unfiltered fuel to flow to the engine fuel system.

## 7. Electrical power supplies

### A. General

The fuel flow indicating system (with engine mounted flowmeters) is powered by the respective engine PS1 or PS2 busbar but all other electrically operated fuel feed system controls and indicators are powered by the PE busbar.

The left and right tank booster pumps are normally powered, respectively, from the PS1 and PS2 busbars but in an emergency the fuel pumps may be powered from the PE busbar.

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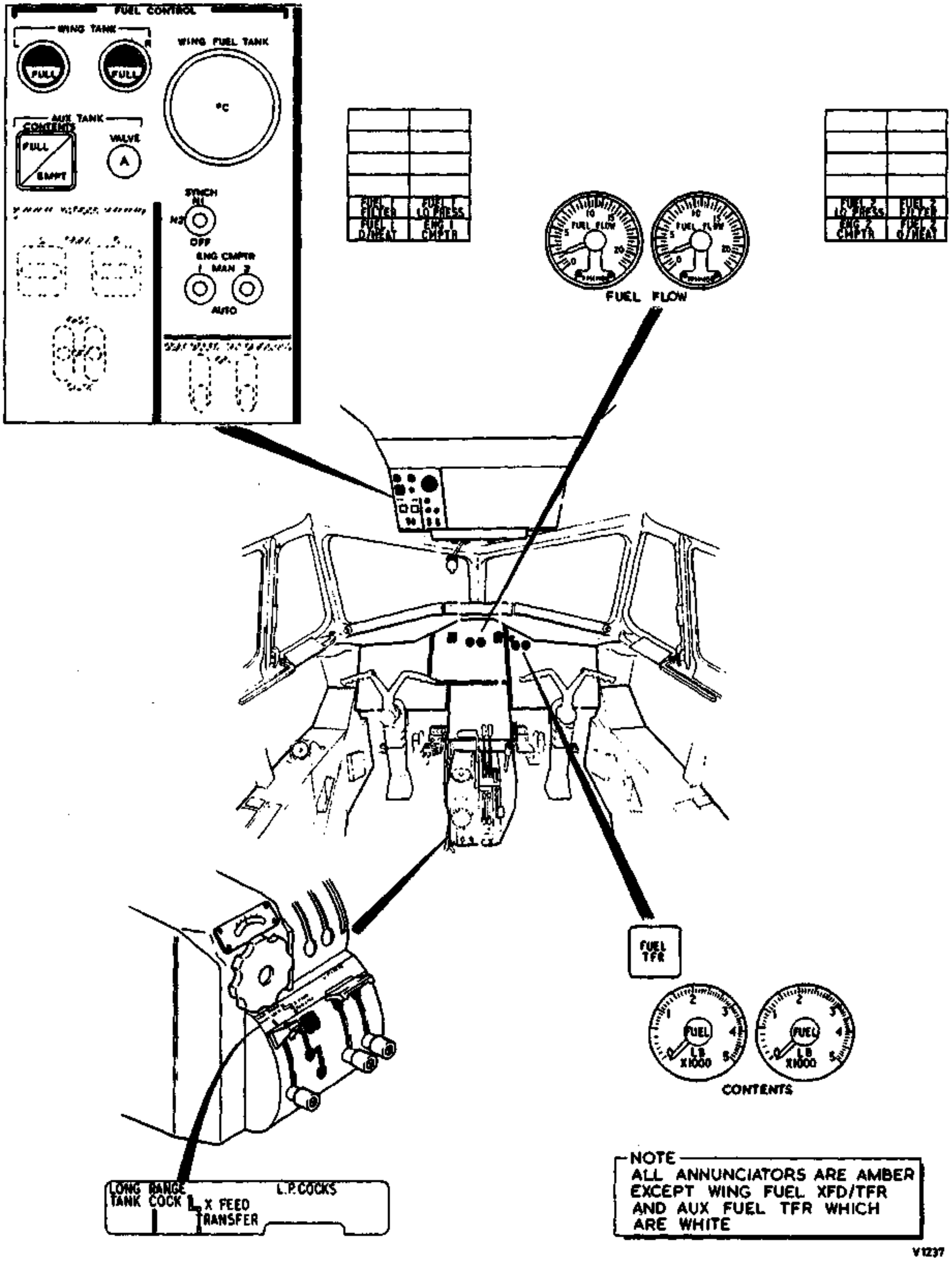


NOTE
ALL ANNUNCIATORS ARE AMBER EXCEPT WING FUEL XFD/TFR AND AUX FUEL TFR WHICH ARE WHITE

Fuel system controls and indicators (typical)
Fig.2

* * *

# FUEL FEED SYSTEM (MAIN ENGINES)
# ADJUSTMENT/TEST

## 1. Pressure test fuel feed system

**WARNING: WHEN LEAKAGE IS DETECTED IN A PRESSURIZED PIPELINE OR SYSTEM, RELEASE ALL PRESSURE AND DISCONNECT THE PRESSURE SUPPLY BEFORE ATTEMPTING ANY RECTIFICATION.**

**WARNING: WHENEVER ANY PART OF THE SYSTEM IS DISMANTLED, ADJUSTED, REPAIRED OR RENEWED, SUCH PARTS OF THE SYSTEM AS HAVE BEEN DISTURBED SHALL, AFTER COMPLETION OF THE WORK, BE FLOW TESTED AND THE RESULT RECORDED. THE SYSTEM SHALL ALSO TO BE TESTED TO MAKE SURE THE OPERATION IS CORRECT AND TO PROVE THE INTEGRITY OF THE SYSTEM.**

| Equipment/Material | Part/Item No. |
|---|---|
| Test rig to regulate air supply to 50 psi (3.5 kg/sq.cm) | Local supply |
| Pressure test adapter/fuel outlet pipe alignment rig | TS.120R.53 |
| Blank (A) transfer jet pump nozzle and diffuser | TS.120R.71A |
| Blank (B) wing jet pump nozzle | TS.120R.41A |
| Blank (C) fuel suction NRV | TS.20R.1/5 |
| Blank (D) (not used) | - |
| Blank (E) fuel feed pipe (outboard firewall connection) | TS.43R.1/19 |
| Blank (F) fuel cross-feed | TS.120R.55A |
| Blank (G) cross-feed valve pipe | TS.20R.1/5 |
| Leak detecting solution | Item 604 (Chapter 20-95-601) |

*NOTE: As normally, pressure tests are done only after the system has been broken down, it is assumed that all relevant manhole covers and access panels have been removed.*

### A. Procedure

(1) Remove the non-return valve from suction pipe at the rear of the pump compartment and install blank (C) to pipe.

(2) Install nozzle blank (B) to wing feed jet pump.

(3) Install nozzle/diffuser blank (A) to the fuel transfer jet pump.

*NOTE: Paragraph (4) may be ignored if two sets of blanks are available, to test right and left systems simultaneously.*

(4) Remove cross-feed valve (CROSS-FEED VALVE) and install appropriate blank (C) or (F) to system under test.

(5) Install pressure test adapter/fuel outlet alignment rig to booster pump manhole cover anchor nuts, so that the adapter goes into *fuel outlet elbow.*

(6) Disconnect engine fuel feed pipe, just outboard of firewall. Install blank (E) to fuel feed pipe.

(7) Open relevant engine low pressure fuel valve.

(8) Connect test rig to pressure test adapter/fuel outlet alignment rig.

(9) Slowly pressurize system to 50 psi (3.5 kg/sq cm). Close test rig control valve. Make sure no loss of pressure occurs from system over a period of 10 minutes.

(10) If a leak is suspected, do a check of the couplings and blanks using leak detecting solution. Do not permit solution to contact valves. Rectify leak and re-test system.

(11) If a leak detecting solution has been used, wash affected parts with distilled water and thoroughly dry.

(12) Release all pressure from the system. Disconnect test rig and remove all blanks and adapters.

(13) Using new seals, install valves, connect couplings and pipelines. Wire-lock couplings and unions (Refer to Chapter 28, *PIPE COUPLINGS, CROSS-FEED VALVE and NON-RETURN VALVE).*

(14) Install manhole covers, booster pump(s) and access panels (Refer to Chapter 28, BOOSTER PUMPS and MANHOLE COVERS AND ACCESS PANELS).

(15) Refuel appropriate tank(s) (Refer to Chapter 12, SERVICING - FUEL). Do a check for fuel leaks.

(16) Bleed and flow test relevant fuel feed system (paragraph 2.A. and 2.B).

## 2. Bleed and flow test fuel feed system

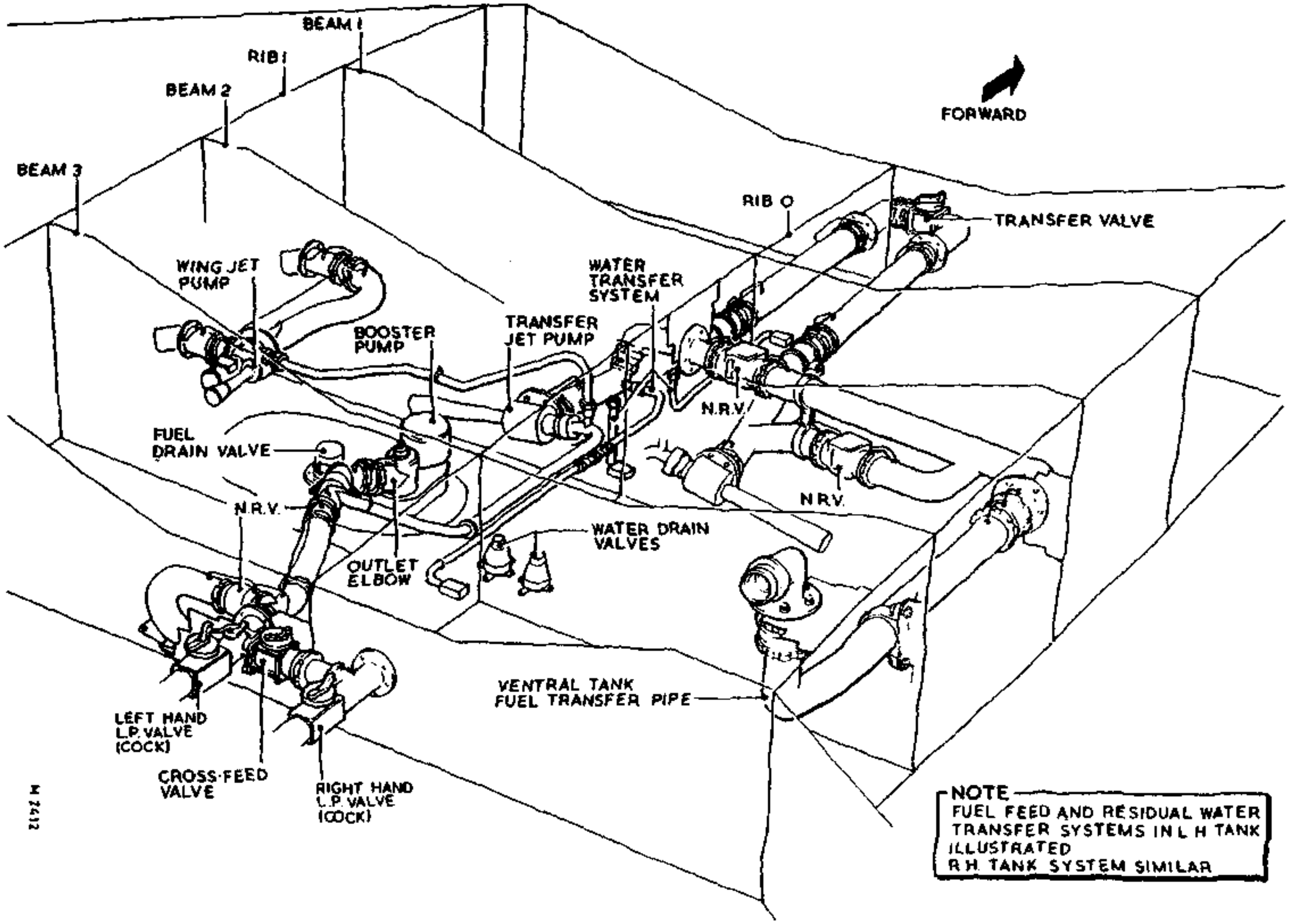
### A. Bleed and flow test fuel feed system with the use of a flow rig

| Equipment/Material | Part/Item No. |
|---|---|
| Flow rig to measure up to 1000 Imp.gal/hr (1201 US.gal/hr, 4540 liters/hr) | Local supply |
| Pressure gauge | 0-20 psi (1.4 kg/sq cm) |
| Adapter, to connect between engine fuel feed pipe and flow rig, with connection for pressure gauge. | Local supply |

**WARNING: THE FLOW RIG AND ALL HOSES MUST BE BONDED TO THE AIRPLANE.**

**WARNING: MAKE SURE THE RELEVANT REFUELLING AND DEFUELLING PRECAUTIONS ARE OBEYED DURING THIS TEST.**

*NOTE: This test details the bleed and fuel flow tests necessary on completion of any work which entailed a major breakdown of a system.*



NOTE
FUEL FEED AND RESIDUAL WATER TRANSFER SYSTEMS IN L H TANK ILLUSTRATED
R H. TANK SYSTEM SIMILAR

Fuel feed system in wings
*Figure 501*

(1) Make sure that the airplane is on level ground

(2) Refuel or defuel until both fuel tank contents indicators read 1,000 lb (454 kg) (Refer to Chapter 12, SERVICING - FUEL).

(3) Disconnect the fuel feed pipe from the relevant system engine and connect adapter, complete with gauge, to pipe.

(4) Connect flow rig inlet hose to adapter and route flow rig outlet hose into the filler neck of the tank (of the system under test). Bond rig and hoses to airplane.

(5) Open the low pressure valve, in the system under test.

(6) Energize d.c. busbars (Refer to Chapter 24, ELECTRICAL POWER - GENERAL).

(7) Switch the booster pumps and operate the fuel control valve as indicated for the relevant system, in Table 501, to obtain minimum flows and pressures (Table 501). Make sure an air free flow is obtained before recording results.

Fuel flow and pressure
*Table 501*

| | | | | | Flow | | | Pressure | |
|---|---|---|---|---|---|---|---|---|---|
| System under test | Pump | Cross feed valve | Left-hand LP. valve (cock) | Right-hand LP. valve (cock) | US gal/hr. | Imp. gal/hr. | L/hr | psi | kg. sq cm. |
| Left hand | LH - ON | SHUT | OPEN | SHUT | 600 | 500 | 2273 | 12.5 | 0.8789 |
| | RH - ON | OPEN | OPEN | SHUT | 600 | 500 | 2273 | 12.3 | 0.8691 |
| Right hand | RH - ON | SHUT | SHUT | OPEN | 600 | 500 | 2273 | 12.5 | 0.8789 |
| | LH - ON | OPEN | SHUT | OPEN | 600 | 500 | 2273 | 12.3 | 0.8691 |

(8) Switch OFF booster pump, disconnect and remove all test equipment.

(9) Connect and lock engine fuel feed pipe. Do a leak check of the engine fuel feed pipe connection.

(10) Purge engine fuel system of air (Allied Signal Light Maintenance Manual Report No. 72-02-15). Chapter 72, GENERAL SERVICING).

(11) De-energize the d.c. busbars (Refer to Chapter 24, ELECTRICAL POWER - GENERAL).

**B. Bleed and flow test fuel feed system without the use of a flow rig.**

**WARNING: THE OPEN CONTAINER, FLOW RIG AND ALL HOSES MUST BE BONDED TO THE AIRPLANE.**

**WARNING: MAKE SURE THE RELEVANT REFUELLING AND DEFUELLING PRECAUTIONS ARE OBEYED DURING THIS TEST.**

*NOTE: This test details the bleeding and fuel flow tests necessary on completion of any work which entailed a major breakdown of a system*

| Equipment/Material | Part/Item No. |
|---|---|
| Adapter | 25YTS303R and fuel hose |
| Pressure gauge | 0-20 psi (1.4 kg/sq cm) |
| Open fuel container | Local supply |
| Stop watch | Local supply |

(1) Make sure that the airplane is on level ground.

(2) Refuel or defuel until both fuel tank contents indicators read 1,000 lb (454 kg) (Chapter 12, SERVICING - FUEL).

(3) Disconnect the fuel feed pipe from the relevant system engine and connect adapter, complete with gauge, to pipe. Direct adapter hose into open container, bond container to airplane. Open adapter control valve.

(4) Open the low pressure valve, in the system under test, make sure opposite system's low pressure valve is closed.

(5) Energize the d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL)

(6) Switch ON the opposite fuel feed system booster pump and open the cross-feed valve. After approximately 15 seconds switch booster pump of system under test to ON.

(7) When an airfree flow of fuel is obtained from adapter hose outlet, close the cross-feed valve and switch OFF the opposite system's booster pump. Adjust control valve on adapter until gauge reads appropriate pressure as shown in Table 501, switch OFF booster pump of system under test.

(8) Empty fuel container. Switch booster pump of system under test to ON. Make sure the rate of flow is in accordance with that given in Table 501. Switch OFF booster pump.

(9) Open cross-feed valve, select opposite system booster pump ON, adjust control valve on adapter until gauge reads appropriate pressure as shown in Table 501. Switch OFF booster pump.

(10) Empty fuel container. Switch ON opposite system's booster pump. Make sure the rate of flow is in accordance with that given in Table 501. Switch OFF booster pumps. Close low pressure and cross-feed valves.

(11) Disconnect and remove all test equipment.

(12) Connect and lock engine fuel feed pipe. Do a check of the engine fuel feed pipe for leaks.

(13) Purge engine fuel system of air (Allied Signal Light Maintenance Manual Report No. 72-02-15). Chapter 72, GENERAL SERVICING).

## 3. Pressure test fuel transfer system

**WARNING: WHEN LEAKAGE IS DETECTED IN A PRESSURIZED PIPELINE OR SYSTEM, RELEASE ALL PRESSURE AND DISCONNECT THE PRESSURE SUPPLY BEFORE ATTEMPTING ANY RECTIFICATION.**

**WARNING: WHENEVER ANY PART OF THE SYSTEM IS DISMANTLED, ADJUSTED, REPAIRED OR RENEWED, SUCH PARTS OF THE SYSTEM AS HAVE BEEN DISTURBED SHALL, AFTER COMPLETION OF THE WORK, BE FLOW TESTED AND RESULT RECORDED. THE SYSTEM SHALL ALSO TO BE TESTED TO MAKE SURE THE OPERATION IS CORRECT AND TO PROVE THE INTEGRITY OF THE SYSTEM.**

| Equipment/Material | Part/Item No. |
|---|---|
| Test rig to regulate air supply to 10 psi (0.7 kg/sq cm) | Local supply |
| Pressure test adapter, ventral tank transfer valve outlet pipe | Local supply |
| Blank transfer jet pump nozzle and diffuser (two required) | TS120R71A |
| Blank water transfer pipes (six required) | TS44R1/1 |
| Leak detecting solution | Item 604 (Chapter 20-95-601) |

*NOTE: As pressure tests are normally done only after the system has been broken down, it is assumed that all relevant manhole covers and access panels have been removed.*

### A. Procedure

(1) Remove the long range tank transfer valve (LONG RANGE TANK TRANSFER VALVE).

(2) Install the pressure test adapter to the long range tank fuel transfer pipe.

**CAUTION: DO NOT DISTURB THE WATER TRANSFER PIPE TO PICK-UP POINT SEALING, DURING PARAGRAPH (3).**

(3) Disconnect the water transfer pipes in both wing tanks and install blanks to fuel transfer pipes.

(4) Install blanks to the left and right transfer jet pump nozzles and diffusers.

(5) Connect test rig to pressure test adapter.

(6) Slowly pressurize system to 10 psi (0.7 kg/sq cm). Close test rig control valve and make sure no loss of pressure occurs over a period of 10 minutes.

(7) If a leak is suspected, do a check of the couplings and blanks using leak detecting solution. Do not permit solution to contact valves. Rectify leak and re-test system.

(8) If a leak detecting solution has been used, wash affected parts with distilled water and thoroughly dry.

(9) Release all pressure from system. Disconnect test rig and remove all blanks and adaptors.

(10) Using new seals, install long range tank fuel transfer valve (LONG RANGE TRANSFER VALVE) and connect couplings (PIPE COUPLINGS). Connect water transfer pipes. Wire-lock couplings and pipe unions.

(11) Install manhole covers, booster pumps and access panels (PUMPS and MANHOLE COVER AND ACCESS PANELS).

(12) Refuel wing and long range tanks (Chapter 12, SERVICING - FUEL). Open LONG RANGE FUEL cock and do a check for leaks. Close LONG RANGE FUEL cock.

## 4. Test fuel transfer system

### A. Test fuel transfer system - between wing tanks

(1) Energize the d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL). Maintain 28 to 28.5 volts during test.

(2) Refuel each tank to an indicated 2,000 lb (907 kg).

(3) Close both LP valves.

(4) Switch ON left booster pump.

(5) Set X-FEED/TRANSFER control lever to TRANSFER and make sure the time taken to reach a gauge reading of 3,000 lb (1361 kg) in the left tank does not exceed 13 min.

(6) Switch OFF left booster pump. Switch ON right booster pump.

(7) Make sure the time taken to reach a gauge reading of 2,000 lb (907 kg) in the right tank does not exceed 13 mins.

(8) Switch OFF right booster pump.

(9) De-energize the d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL).

### B. Test fuel transfer - long range tank to wing tanks

**CAUTION: IF EQUIPMENT HAS BEEN REMOVED FROM FRONT OF AIRPLANE OR PERSONNEL ARE IN, OR ON, REAR OF AIRPLANE, INSTALL JACK TO REAR JACKING POINT.**

(1) Move LONG RANGE TANK COCK control lever to shut (up), close both LP COCKS and set X-FEED/TRANSFER control lever to the closed (normal feed) position.

(2) Energize the d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL) maintaining 28 to 28.5 volts during test.

(3) Do a check of the indicated contents of each wing tank and make sure they are equal and each wing tank is between 1,000 and 3,360 lb (454 and 1377 kg).

(4) Refuel or defuel wing tanks, as necessary, and fill long range tank.

(5) Make sure the AUX CONTENTS indicator registers FULL.

(6) Open LONG RANGE TANK COCK and select both fuel pump switches to ON and record time.

(7) Make sure the AUX CONTENTS indicator changes to 'cross hatched' and then when it registers EMPTY, record the time; make sure the transfer time has not exceeded 6 minutes if wing tank contents were initially 1,000 lb (454 kg), or 7 minutes if wing tanks contents initially exceeded 1,000 lb (454 kg), and that wing tank contents are within 100 lb (45.4 kg) of each other.

*NOTE: If tank contents initially exceeded 1,000 lb (454 kg) and transfer time exceeded 7 minutes, defuel each wing tank to 1,000 lb (454 kg), fill ventral tank and repeat test.*

(8) Select both fuel PUMP switches OFF and close LONG RANGE TANK COCK.

(9) De-energize the d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL).

## 5. Test pump compartment drain rate and jet pump performance

| Equipment/Material | Part/Item No. |
|---|---|
| Airplane jacks, adapters and wing trestles | Local supply |
| Refuelling rig of known accuracy | Local supply |
| Sight glass assembly | 25YTS120R29A |
| Fuel drain adapter | 25Y867A |
| Stopwatch | Local supply |
| DC voltmeter | 0-50 volts |

### A. Procedure *(Figure 502)*

(1) Raise the airplane on jacks and put in a wing level position with wing trestles (Chapter 7, JACKING AND TRESTLING)

(2) Drain both wing tanks to water drain level. (Chapter 12, SERVICING - FUEL).

(3) Connect the fuel drain adapter to the left tank fuel drain valve.

(4) Connect sight glass assembly to the fuel drain adapter *(Figure 502)*.

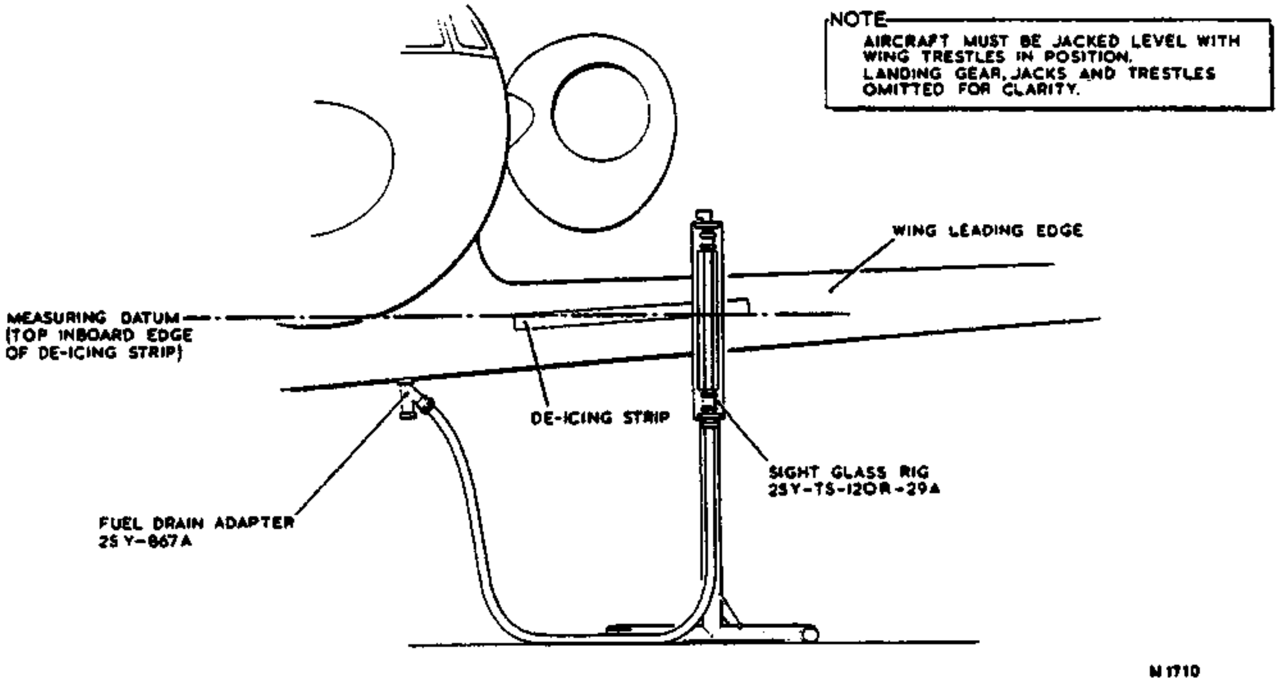
(5) In the flight compartment set fuel controls as follows:

| | |
|---|---|
| X-FEED TRANSFER lever | Closed (normal feed) |
| No.1 and No.2 engine LP COCKS | Closed |
| LONG RANGE TANK COCK lever | Shut |

(6) Refuel each wing tank (via over-wing filler) with 75 Imp.gal. (90 US. gal., 340 liters) of fuel (Refer to Chapter 12, SERVICING - FUEL).

(7) Allow fuel to settle for a period of 5 minutes. Make sure the fuel in the sight glass is approximately 4 in. below the measuring datum.

(8) Install filler cap to left tank.


NOTE
AIRCRAFT MUST BE JACKED LEVEL WITH WING TRESTLES IN POSITION.
LANDING GEAR, JACKS AND TRESTLES OMITTED FOR CLARITY.
WING LEADING EDGE
MEASURING DATUM (TOP INBOARD EDGE OF DE-ICING STRIP)
DE-ICING STRIP
SIGHT GLASS RIG 25Y-TS-120R-29A
FUEL DRAIN ADAPTER 25 Y-867A
N 1710

Fuel level measuring datum
*Figure 502*

(9) Energize the d.c. busbars (Refer to Chapter 24, ELECTRICAL POWER - GENERAL) and maintain a constant 28 to 28.5 volts for the duration of tests.

(10) Switch ON the left booster pump. At pump terminal block, using d.c voltmeter, make sure the voltage is at least 26.5 volts.

(11) With pump running, make sure the level in the sight glass stabilizes at 5 to 5.5 in. (127.0 to 139.7 mm) above the measuring datum.

(12) When the level has stabilized for 3.5 minutes, switch OFF left booster pump and make sure the level in the sight glass drops to 0.75 in. (19.05 mm) above the measuring datum in not less than 6 minutes and not more than 18 minutes.

(13) When the fuel in the sight glass reaches the measuring datum, switch ON the left booster pump and make sure the level rises to 4.5 in. above the measuring datum in less than 65 seconds.

(14) Switch OFF the left booster pump.

(15) Remove the sight glass assembly and fuel drain adapter from the left tank fuel drain valve.

(16) Connect the fuel drain adapter and sight glass assembly to the right tank fuel drain valve.

(17) Repeat paragraphs (7) to (14) for the right tank using the right booster pump.

(18) Remove the sight glass assembly and fuel drain adapter from the right tank fuel drain valve.

(19) Bleed engine fuel feed systems (Refer to Chapter 73, ENGINE FUEL AND CONTROL - GENERAL).

# FUEL FEED SYSTEM (APU) - DESCRIPTION AND OPERATION

## 1. Description

Fuel is fed to the a.p.u. from a tapping in the No.1 engine fuel feed pipe, downstream of the low pressure fuel shut-off valve. The a.p.u. fuel feed system (Fig.1) comprises a solenoid operated valve, an electric pump, non-return valve, filter, pressure switch and the associated piping, pipe couplings and special adapters. The pump, non-return valve, filter and pressure switch are assembled on a mounting tray and enclosed within a detachable glass fibre cover, the complete assembly being mounted on the main engine spar (in the rear equipment bay), below the a.p.u.

Mounted on the No.1 engine fuel feed pipe tapping by its inlet connection, the solenoid operated valve connects to the fuel pump and filter assembly inlet. Within the assembly, the inlet pipe bifurcates to supply both the pump and the non-return valve, the pump and non-return valve outlets join, via a block and pipe assembly, at the filter inlet. A double banjo connection at the fuel filter outlet provides a tapping for the pressure switch and also a connection for the flexible outlet hose to the a.p.u. fuel control assembly.

The electrical control system, comprising the a.p.u. MASTER switch, fuel pump and starter isolating relays, No.1 engine l.p. fuel switch and indicator, and the a.p.u. low pressure fuel switch and indicator, is supplied from the PE busbar. (Fig.2).

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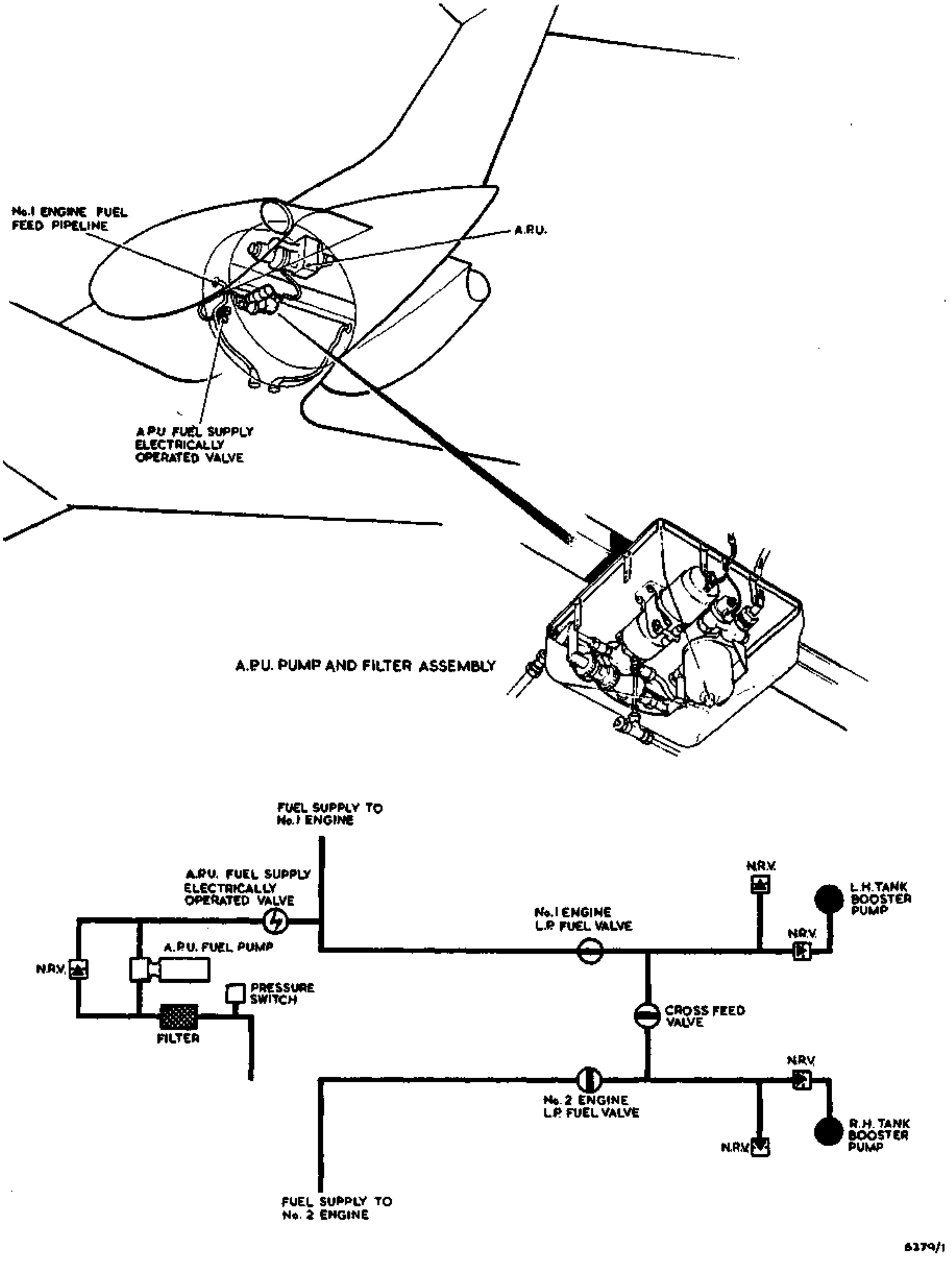
## 2. Operation (Figs.1 and 2)

With the aircraft booster pumps OFF, the No.1 engine low pressure fuel switch contacts are closed and the a.p.u. fuel pump relay is energized. When the a.p.u. MASTER switch is selected ON, the solenoid operated valve is opened and the a.p.u. fuel pump runs. The pump draws fuel from the No.1 engine fuel feed pipe and pumps it via the filter to the a.p.u. fuel control assembly.

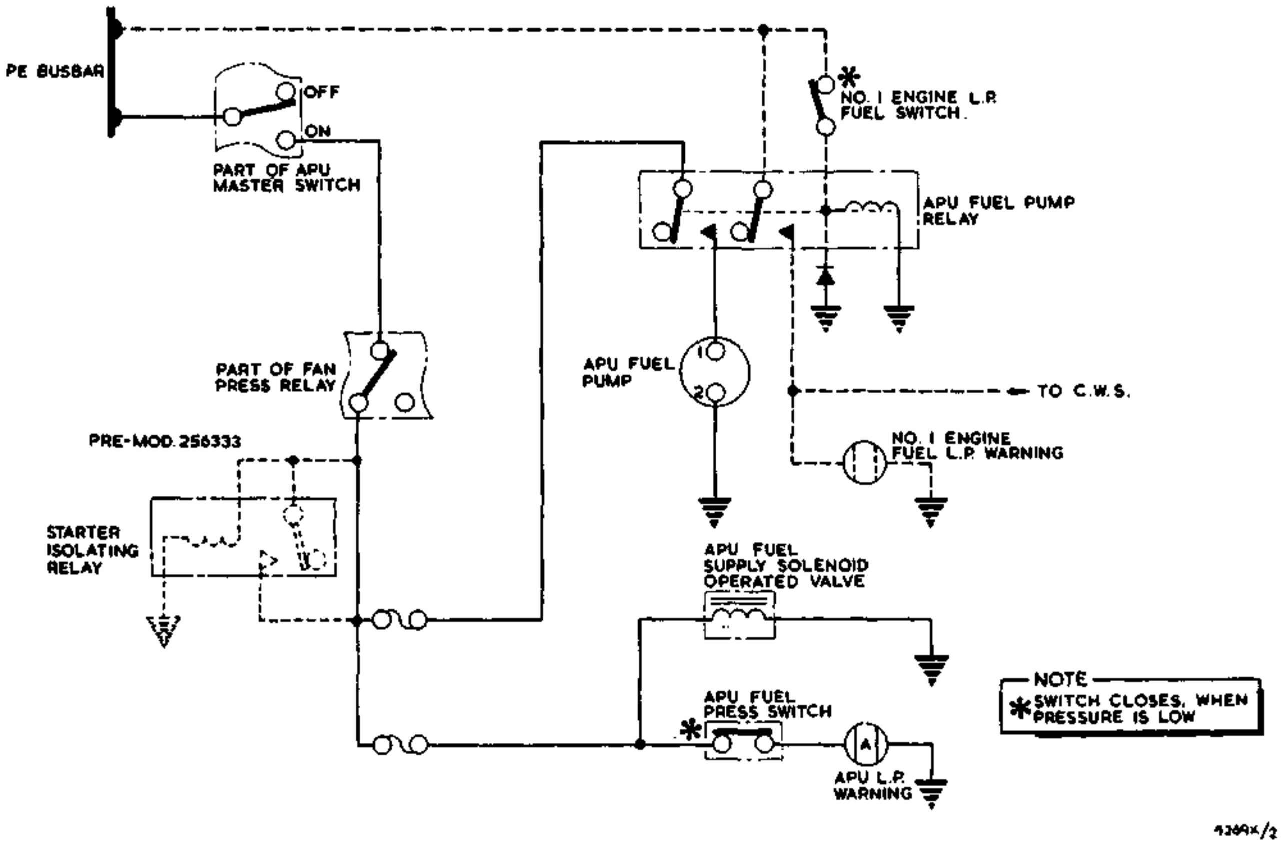
If the aircraft booster pumps are ON, when the a.p.u. MASTER switch is selected to ON, the a.p.u. fuel pump relay will be de-energized (due to the No.1 engine l.p. fuel switch contacts being open), and the solenoid operated valve will open, allowing fuel from the No.1 engine fuel feed pipe to by-pass the pump and flow through the non-return valve and filter to the a.p.u. fuel control assembly.

At all times when the a.p.u. is in use, the No.1 engine low pressure fuel shut-off valve must be open.

If the fuel pressure in the a.p.u. system is low, the a.p.u. pressure switch contacts will close and the amber warning indicator, on the a.p.u. panel in the flight compartment, will light.


No.1 ENGINE FUEL FEED PIPELINE
A.P.U.
A.P.U. FUEL SUPPLY ELECTRICALLY OPERATED VALVE
A.P.U. PUMP AND FILTER ASSEMBLY
FUEL SUPPLY TO No.1 ENGINE
A.P.U. FUEL SUPPLY ELECTRICALLY OPERATED VALVE
A.P.U. FUEL PUMP
N.R.V.
PRESSURE SWITCH
FILTER
No.1 ENGINE L.P. FUEL VALVE
N.R.V.
L.H. TANK BOOSTER PUMP
N.R.V.
CROSS FEED VALVE
N.R.V.
No.2 ENGINE L.P. FUEL VALVE
R.H. TANK BOOSTER PUMP
N.R.V.
FUEL SUPPLY TO No.2 ENGINE
6379/1

APU fuel feed system
Fig.1



APU fuel feed system - Control circuit
Fig.2

* * *

## FUEL FEED SYSTEM (APU) - MAINTENANCE PRACTICES

### 1. Adjustment/Test

WARNING : WHEN LEAKAGE IS DETECTED IN A PRESSURIZED PIPELINE OR SYSTEM, RELEASE ALL PRESSURE AND DISCONNECT THE PRESSURE SUPPLY BEFORE ATTEMPTING ANY RECTIFICATION.

### A. Pressure test a.p.u. fuel feed system

NOTE : When possible, the a.p.u. fuel feed system should be pressure tested with the main fuel feed system (see Chapter 28, FUEL FEED SYSTEM).

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Equipment required :-

Test rig to regulate air supply to 50 lb/sq.in. (3.5 kg/sq.cm.).
Pressurizing adapter (5/8 in. BSP to connect with type of rig in use).
Blank HSA TS-45R-1/7.
Leak detecting solution (5% Nonidet LE , 95% distilled water).

(1) Isolate solenoid operated valve electrical circuit (see Chapter 24, GENERAL).

(2) Gain access to the rear equipment bay.

(3) Disconnect the a.p.u. fuel pump gland seal drain, at the base of the a.p.u. pump and filter assembly.

(4) Carefully remove the pump and filter assembly cover, ensuring that the fuel pump and pressure switch electrical leads are not strained.

(5) Disconnect the flexible fuel supply hose, between the pump and filter assembly and the a.p.u., at the a.p.u. Fit blank TS-45R-1/7 to the hose.

(6) Disconnect the electrical leads from the solenoid operated valve, and the bonding flex between the valve and pipes.

(7) Disconnect the fuel supply pipe from the solenoid valve outlet. Remove the valve and adapter from the No.1 engine fuel feed pipe. Retain bolts and adapter, discard the O-ring seals.

(8) Fit the pressurizing adapter to the a.p.u. fuel supply pipe and connect test rig to pressurizing adapter.

(9) Open test rig control valve and pressurize the a.p.u. fuel feed system to 50 lb/sq.in. (3.5 kg/sq.cm.). Close test rig control valve, and check that no loss of pressure occurs over a period of 10 minutes.

(10) If a leak is apparent, check couplings, pipe unions and blanks using leak detecting solution : Observe WARNING : Rectify leak and then retest system.

...APU fuel feed system - maintenance practices continued

(11) If a leak detecting solution has been used, wash all affected areas with distilled water and thoroughly dry.

(12) Release all pressure from the system. Disconnect test rig and pressurizing adapter.

(13) Locate new O-ring seals in the valve adapter grooves. Fit solenoid operated valve and adapter, to the No.1 engine fuel feed pipe. Tighten attachment bolts.

(14) Connect, tighten and wire-lock the a.p.u. fuel supply pipe to the solenoid operated valve outlet.

(15) Connect and secure the solenoid operated valve electrical leads to the valve terminals, and the bonding flex between valve and pipelines.

(16) Remove the blank, and connect the flexible fuel supply hose to the a.p.u.

(17) Restore solenoid operated valve electrical circuit.

(18) Bleed the a.p.u. and purge engine fuel feed systems (see Garrett AiResearch Report No.72-02-56, Chapter 72-00-00 - GENERAL SERVICING).

(19) Energize the PE busbar, open the No.1 engine low pressure fuel shut-off valve and select a.p.u. MASTER switch ON. Check the a.p.u. fuel feed system, from the solenoid operated valve to a.p.u. for leaks. Switch OFF the a.p.u. MASTER switch, close the No.1 engine low pressure fuel shut-off valve and de-energize the PE busbar.

(20) Fit the a.p.u. fuel pump and filter assembly cover, fasten Dzus fasteners. Ensure that the fuel pump and pressure switch leads do not become trapped and that the grommet locates in cover slot.

(21) Connect, tighten and wire-lock the a.p.u. fuel pump gland seal drain pipe, at the base of the cover.

## B. Flow test a.p.u. fuel feed system

Equipment required :-

Calibrated open container. Capacity 5 Imp.gals. (6 U.S.gals., 23 litres)
Stop watch

(1) Gain access to the rear equipment bay.

(2) Disconnect the flexible fuel supply hose, between the pump and filter assembly, and the a.p.u. at the a.p.u. Position the calibrated open container, and direct the flexible fuel supply hose into it. Bond the container to the aircraft.

(3) Energize the d.c. busbars, open the No.1 engine low pressure fuel shut-off valve and select a.p.u. MASTER switch ON. Check that 1 Imp.gal (1.2 U.S. gal., 4.5 litres) flow into the container over a period of 2 minutes. Select a.p.u. MASTER switch OFF.

(4) Empty calibrated container, reposition and bond to aircraft as in operation (2).

(5) Switch ON the left-hand booster pump, select a.p.u. MASTER switch ON. Check that a full bore flow of fuel flows into the container. Switch OFF a.p.u. MASTER and the left-hand booster pump switches, close the No. 1 engine low pressure fuel shut-off valve and de-energize the PE busbar.

(6) Connect the a.p.u. flexible fuel feed supply hose.

(7) Bleed the a.p.u. fuel feed system (see para.C).

NOTE : The a.p.u. flexible fuel feed supply hose is tightened and wire-locked during bleeding.

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C. Bleed a.p.u. fuel feed system

Equipment required :-

Open container

(1) Gain access to the rear equipment bay.

(2) Position the open container under the a.p.u. fuel feed supply hose. Bond container to the aircraft.

(3) Slacken the flexible fuel feed supply hose, between the pump and filter assembly, and the a.p.u., at the a.p.u., sufficiently to obtain an escape of fuel from the union.

(4) Energize the d.c. busbars, open the No.1 engine low pressure fuel shut-off valve, switch ON the left-hand fuel booster pump and select the a.p.u. MASTER switch ON. Check a.p.u. fuel pressure lamp lights. When there is evidence of fuel at the slackened union switch OFF the left-hand fuel booster pump.

NOTE : When the fuel booster pump is switched OFF the a.p.u. fuel pump will run.

(5) When fuel exudes from flexible hose under a.p.u. fuel pump pressure, tighten union

...APU fuel feed system - Maintenance practices continued

(6) Switch ON the left-hand fuel booster pump and ensure that the a.p.u. fuel pressure light extinguishes. Check hose for leaks. Switch OFF the left-hand fuel booster pump and a.p.u. MASTER switch, close the No. 1 engine low pressure fuel shut-off valve and de-energize the d.c. busbars.

(7) Wire-lock the flexible fuel supply hose.

(8) Remove the fuel container.

* * *

## BOOSTER PUMP - MAINTENANCE PRACTICES

NOTE : These maintenance practices cover three types of booster pump which are:- Intertechnique, Thompson and Airborne. All the above pumps are interchangeable, but the drain valve which is installed on the Intertechnique and Thompson pumps, is not required on the Airborne pump. Refer to Para.1.A.(11).

### 1.Removal/Installation

#### A.Remove booster pump

(1) Isolate the relevant electrical circuit (see Chapter 24 - GENERAL).

(2) Close low pressure, cross-feed and transfer valves.

(3) Defuel the relevant fuel tank.

(4) Remove the six screws retaining pump fairing and remove fairing.

(5) Disconnect pump electric cables.

(6) Remove nut, washer and O-ring seal from base of outlet elbow reach bolt.

(7) Remove base plug from reach bolt, remove and discard O-ring seal.

(8) Remove pump retaining bolts. Support the weight of the pump and gently push up the reach bolt to release fuel pump outlet connection from pump.

(9) Remove pump : inspect packing gasket and discard if unserviceable.

(10) Remove and discard o-ring seal from fuel outlet elbow.

(11) Transfer pump gland drain assembly from pump removed to pump to be installed.

NOTE : This drain transfer is only necessary if an Intertechnique or a Thompson booster pump is being installed. For Airborne pump installation, it is recommended that, the drain assembly be removed and retained for subsequent installation of Intertechnique or Thompson booster pumps.

#### B.Install booster pump

(1) Inspect new pump for sharp edges particularly at base plug recess where O-rings are to be fitted.

(2) Ensure seal groove in fuel outlet elbow is clean and fit a new O-ring seal.

..Booster pump - maintenance practices continued

(3) Ensure that pump flange and pump mounting flange is clean, fit packing gasket.

(4) Fit pump assembly; temporarily support pump with two diametrically - opposed attachment bolts and, using the reach bolt, draw outlet connection into the outlet of the pump.

(5) Ensure base plug seal recess is clean and fix a new O-ring seal into seal recess.

(6) Apply grease DEF STAN 91-56 to base plug O-ring seal and guide the base plug and O-ring seal over the reach bolt and into the recess.

(7) Fix cable link and six special bolts (see Fig.201).

(8) Fix remaining bolts; tighten all bolts evenly.

(9) Wirelock reach bolt retaining nut to adjacent pillar (Refer to Fig.201).

(10) Adjust pump gland, drain assembly so that the 45° cut-off faces aft.

NOTE : The adjustment of the pump gland, drain assembly is only applicable to Intertechnique and Thompson booster pumps.

(11) Connect electric cables.

(12) Ensure all fuel drain valves are closed.

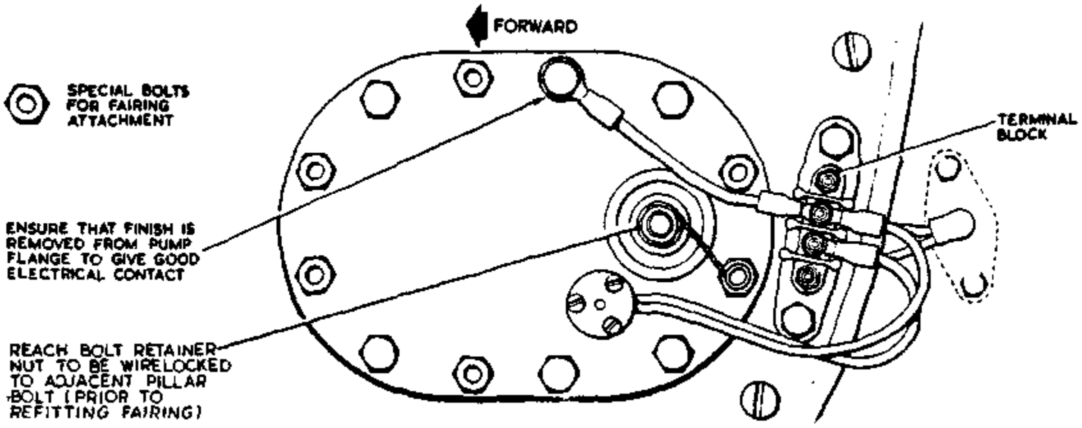
(13) Refuel tank and check for leaks.

(14) Restore booster pump electrical circuit (see Chapter 24 - GENERAL).

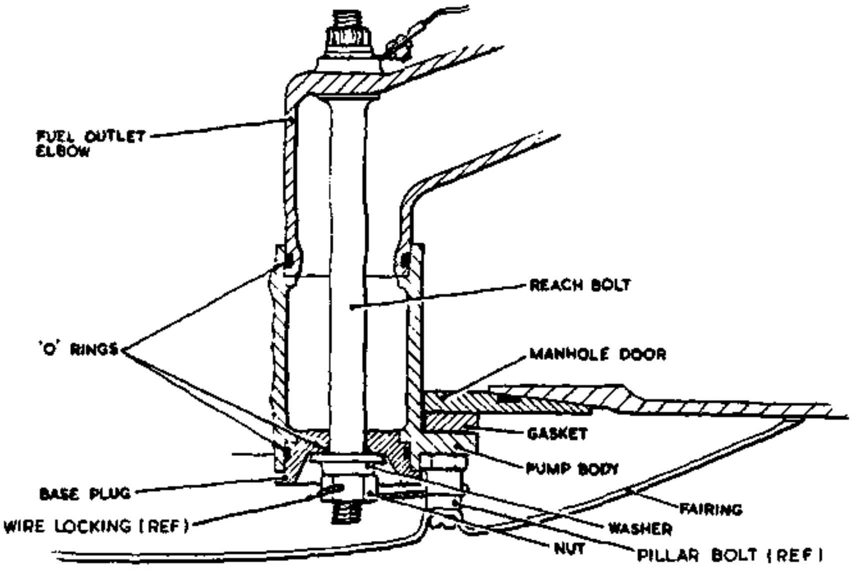
(15) Open L.P. valve, switch 'ON' booster pump and ensure that associated fuel low pressure warning light goes out. Switch 'OFF' booster pump.

(16) Fix pump fairing cover; wirelock.

..Booster pump - maintenance practices continued


FORWARD
SPECIAL BOLTS FOR FAIRING ATTACHMENT
TERMINAL BLOCK
ENSURE THAT FINISH IS REMOVED FROM PUMP FLANGE TO GIVE GOOD ELECTRICAL CONTACT
REACH BOLT RETAINER NUT TO BE WIRELOCKED TO ADJACENT PILLAR BOLT (PRIOR TO REFITTING FAIRING)

PUMP ATTACHMENT BOLTS AND ELECTRICAL CONNECTIONS



FUEL OUTLET ASSEMBLY

5431/1

Booster pump installation
Fig.201

* * *

# NON-RETURN VALVES - MAINTENANCE PRACTICES

## 1.Removal/Installation

### A.Remove fuel feed system non-return valve - Tank compartment No.1 (Chap. 28-20-01, Fig.201).

NOTE: Owing to the restricting depth of the wing structure and location of the components in the structure it may be necessary to undertake some operations using a mirror.

(1) Close the crossfeed, both low pressure valves and ventral tank transfer valve.

(2) Drain appropriate wing tank (see Chapter 12, SERVICING - FUEL).

(3) Remove No.1 compartment manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS) to gain access to the non-return valve. The non-return valve is located in the pressure feed line downstream of the booster pump.

(4) Remove the clip pinching the bonding flex to the non-return valve.

(5) Disconnect the bonding flex from the AVIMO pipe coupling body at the valve inlet.

(6) Remove the locking wire and unscrew the pipe coupling nut at the inlet to the non-return valve.

(7) Release and remove the V-clamp at the other end of the valve.

(8) Remove the non-return valve and discard the O-ring seals.

### B.Install fuel feed system non-return valve - Tank compartment No.1 (Chap. 28-20-01, Fig.201).

(1) Ensure that the non-return valve is undamaged, clean and free from corrosion, distortion and any defects likely to impair sealing action. Ensure serviceability of threads.

(2) Fit the coupling nut, compression ring and new O-ring seal to inlet end of non-return valve.

(3) Locate the non-return valve in the system, lightly screw up the coupling nut at the inlet end connection.

(4) Using a new sealing ring, assemble both halves of the outlet connection and secure with the V-clamp.

(5) Fully tighten the coupling nut at the valve inlet end and wirelock.

(6) Bolt the bonding flex tag to the coupling body at the valve inlet. Bond the flex to the non-return valve stem with the pipe clip. Check bonding resistance in accordance with 20-20-645 (see Chapter 20).

(7) Fit No.1 compartment manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(8) Test the fuel feed system through relevant engine disconnect point (see Chapter 28, FUEL FEED SYSTEM).

(9) When tank is refuelled, check there is no leakage at manhole cover.

### C. Remove suction feed system non-return valve - Tank compartment No.1 (Chap. 28-20-01, Fig.201).

NOTE: Owing to the restricting depth of the wing structure and location of the components in the structure it may be necessary to undertake some operations using a mirror.

(1) Close the cross-feed, both low pressure shut-off and ventral tank transfer valves.

(2) Drain appropriate wing tank (see Chapter 12, SERVICING - FUEL).

(3) Remove the No.1 compartment manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS) to gain access to the non-return valve. The non-return valve is located in the suction feed line.

(4) Remove the bolt securing the bonding flex terminals to the n.r.v. body.

(5) Remove the locking wire and unscrew the pipe coupling nut at inlet to the n.r.v.

(6) Release and remove the V-clamp at the other end of the valve.

(7) Remove the non-return valve and discard the seals.

### D. Install suction feed non-return valve - Tank compartment No.1 (Chapter 28-20-01, Fig.201).

(1) Ensure that the non-return valve is undamaged, clean and free from corrosion, distortion and any defects likely to impair sealing action. Ensure serviceability of threads.

(2) Assemble coupling nut compression ring and new sealing ring to inlet end of n.r.v.

(3) Locate the n.r.v. in the suction line and lightly tighten the coupling nut over the joint with the pipe.

(4) Using a new sealing ring assemble both halves of the clamp assembly and secure with the V-clamp.

(5) Fully tighten the coupling nut at the valve inlet and wirelock.

(6) Assemble both bonding flexes to the boss on rib valve body and secure with the bolt and new tabwasher. Check bonding resistance in accordance with 20-20-645 (see Chapter 20, STANDARD PRACTICES).

(7) Fit No.1 compartment manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(8) Test fuel feed system through relevant engine disconnect point (see Chapter 28, FUEL FEED SYSTEM).

(9) When tank is refuelled, check there is no leakage at manhole cover.

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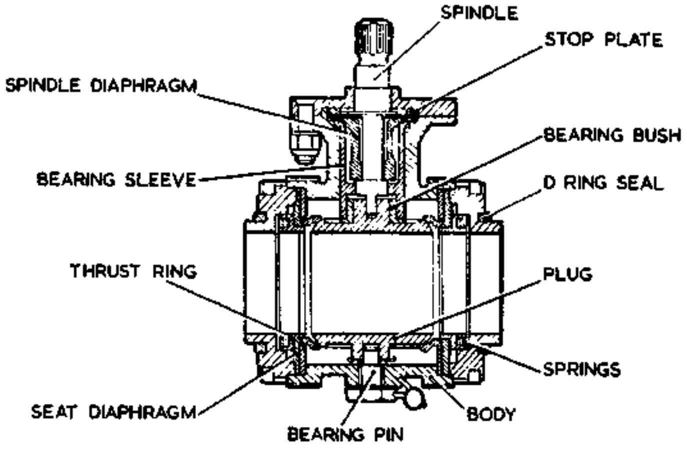
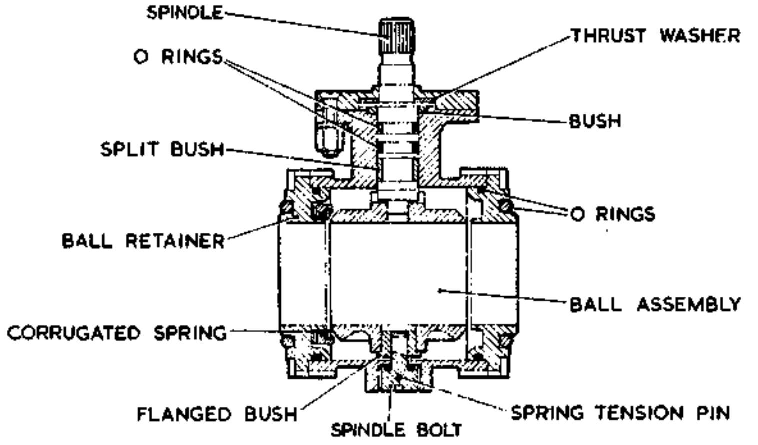
## LOW PRESSURE VALVE (COCK) - DESCRIPTION AND OPERATION

### 1. Description

This valve is a manually-operated on/off valve (cock) of a spherical plug design with a pressure relief valve seat set to operate at 27 to 35 lb/sq.in. (1.898 to 2.46 kg/sq.cm.).



SAUNDERS VALVE 110BG02
(PRE-MOD 252391)



H.T.E. VALVE HTE 1984
(MOD. 252391)

Low pressure valve (cock)
Fig.1

A groove on the outer face of the valve (cock) spindle indicates the bore axis of the plug, while a locating groove ensures correct relationship between plug bore and controlling lever.

* * *

## LOW-PRESSURE VALVE (COCK) - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove low-pressure valve

(1) Open low-pressure valve to be removed. Close all other control valves.

(2) Drain appropriate wing fuel tank (see Chapter 12, SERVICING-FUEL).

(3) Place a suitable fuel container under valve to be removed.

NOTE: The fuel feed pipes may contain a quantity of fuel.

(4) Disconnect bonding flex from valve.

(5) Remove valve operating lever, clamp nut and bolts. Withdraw lever from splined spindle. Retain nut, bolt and lever.

(6) Remove the two screws securing stop plate to low-pressure valve, retain stop plate and screws.

(7) Unlock and disconnect fuel feed pipe coupling from low-pressure valve. Discard O-ring seal.

(8) Remove low-pressure valve and pipe coupling adapter. Discard seal rings.

NOTE: Removal of the low-pressure valve attachment bolts will release the bonding and pipe union locking tabs.

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#### B. Install low-pressure valve

Materials and equipment required :

Fuel, Kerosene (AVTUR)
D-ring seals for Saunders valve, O-ring seals for HTE valve
O-ring seals for coupling adapter
Thiokol - PR 1422 BT½
Torque wrench - 30-35 lb/in

(1) Inspect low-pressure valve for signs of damage or corrosion. Lubricate inside of valve with fuel.

(2) Using two screws, fit and secure stop plate to valve.

(3) Ensure seal grooves in valve are clean. Fit new 'D' ring seals to Saunders valve with flat towards valve, or O-ring seals to HTE valve.

(4) Fit low-pressure valve and pipe coupling adapter. Secure bonding and pipe coupling locking tabs by appropriate valve attachment bolts. Tighten attachment nuts and bolts to 30-35 lb/in torque.

(5) Using a new O-ring seal connect fuel feed pipe coupling to adapter on valve. Tighten and wire-lock union nut.

(6) Connect bonding flex. Check that resistance between valve and earth is not more than 0.05 ohms.

(7) Coat bonding points with Thiokol.

(8) Fit valve operating lever on splined shaft, ensuring that master spline in lever is aligned with the locating groove on spindle. Tighten pinch bolt nut and lock nut with split pin.

(9) Ensure all drain valves are closed. Refuel tank (see Chapter 12, SERVICING-FUEL).

(10) Check drain valves, fuel feed pipe couplings and low-pressure valve for leaks with booster pump running.

(11) Flow test relevant fuel feed system (see Chapter 28, FUEL FEED SYSTEM (MAIN ENGINES)).

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# CROSS-FEED VALVE (COCK) - MAINTENANCE PRACTICES

NOTE : For description of valve, see LOW-PRESSURE VALVE

## 1. Removal/Installation

### A. Remove cross-feed valve

(1) Close low-pressure valves and all other fuel control valves.

(2) Drain right and left-hand fuel tanks (see Chapter 12, SERVICING-FUEL).

(3) Remove valve operating lever clamp nut and bolt. Withdraw lever from splined spindle. Retain nut bolt and lever.

(4) Remove the two screws securing stop plate to cross-feed valve retain stop plate and screws.

(5) Disconnect bonding flex.

(6) Place a suitable fuel container under valve.

(7) Unlock and disconnect pipe coupling from valve. Discard O-ring seal.

(8) Remove cross-feed valve and pipe coupling adapter. Discard seal rings.

NOTE : Removal of the cross-feed valve attachment bolts will release the bonding tag.

### B. Install cross-feed valve

Materials and equipment required :

Fuel, Kerosene (AVTUR)
D-ring seals for Saunders valve, O-ring seals for HTE valve
O-ring seals for coupling adapter
Thiokol - PR 1422 BT½
Torque wrench 30-35 lb/in.

(1) Inspect valve for signs of damage or corrosion. Lubricate inside of valve with fuel.

(2) Using two screws, fit and secure stop plate to valve.

(3) Ensure seal grooves are clean. Fit new D-ring seals to Saunders valve with flat towards valve or O-ring seals to HTE valve.

(4) Fit cross-feed valve and pipe coupling adapter. Secure bonding tab by appropriate attachment bolt. Tighten attachment nuts and bolts to 30-35 lb/in torque.

(5) Fit a new O-ring seal and connect pipe coupling. Tighten coupling and wire-lock.

...Cross-feed valve (cock) - Maintenance practices continued

(6) Connect bonding flex. Check that resistance between valve and earth is not more than 0.05 ohms.

(7) Coat bonding points with Thiokol.

(8) Fit valve operating lever to splined shaft, tighten pinch bolt.

(9) Ensure all drain valves are closed. Refuel tanks as required.

(10) Check drain valves, pipe couplings and cross-feed valve for leaks with booster pump running.

(11) Flow test fuel feed systems (see Chapter 28, FUEL FEED SYSTEM).

* * *

# TRANSFER VALVE (COCK) - MAINTENANCE PRACTICES

NOTE : For description of valve, see LOW-PRESSURE VALVE.

## 1. Removal/Installation

### A. Remove transfer valve

(1) Remove transfer valve as described in Chapter 28, CROSS-FEED VALVE.

### B. Install transfer valve

(1) Install transfer valve as described in Chapter 28, CROSS-FEED VALVE.

(2) Functionally test fuel transfer system (see Chapter 28, FUEL FEED SYSTEM).

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# LONG RANGE TANK FUEL TRANSFER VALVE - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove long range tank fuel transfer valve

(1) Open long range tank fuel transfer valve.

(2) Defuel and drain the long range tank (see Chapter 12, SERVICING - FUEL).

(3) Fit landing gear locking pins (see Chapter 10, PARKING AND MOORING).

(4) Release hydraulic system pressure (see Chapter 29, MAIN SYSTEM).

(5) Lower the right-hand main landing gear door.

(6) Remove long range fuel transfer valve access panel.

(7) Disconnect bonding from fuel transfer valve.

(8) Position an open fuel container below main landing gear to fuselage fairing; bond container to aircraft.

(9) Slacken pipe coupling at transfer valve outlet and allow fuel to drain, where possible, into container. Wipe up excess fuel and remove open container.

(10) Disconnect transfer valve outlet pipe coupling; discard O-ring seal.

(11) Supporting the transfer valve, remove the four nuts and bolts securing valve. Lower the valve and disengage splined shaft from valve lever. Withdraw transfer valve through access panel aperture. Retain pipe adapter, nuts and bolts, bonding and locking tags.

(12) Remove the valve lever clamp nut and bolt. Withdraw lever from splined valve spindle. Retain nut, bolt and lever.

(13) Remove the two screws securing stop plate to transfer valve; retain stop plate and screws.

(14) Fit blanks to fuel transfer pipe and tank extension adapter.

### B. Install long range tank fuel transfer valve

Materials and equipment required :

O-ring seals for valve
O-ring seals for adapter
Torque wrench, 30-35 lb/in.

(1) Examine replacement transfer valve for signs of damage or corrosion. Ensure that valve rotates freely from open to close, when turned by hand.

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...Long range tank fuel transfer valve - Maintenance practices continued

(2) Using the two screws, fit and secure stop plate to valve.

(3) Aligning master splines, fit lever to valve spindle and secure with clamp nut and bolt.

(4) Ensure that valve fully opens and fully closes, when valve lever is moved to its open and closed stops.

(5) Remove blanks from fuel transfer pipe and tank extension adapter.

(6) Fit new O-ring seals to transfer valve position pipe adapter on valve. Ensuring bonding faces are clean, fit bonding and locking tags under head of bolts, slide the bolts through pipe adapter and valve body.

(7) Engaging the valve lever and control shaft splines, align transfer valve with tank extension adapter. Fit and tighten nuts to 30-35 lb/in torque.

(8) Using a new O-ring seal, connect fuel transfer pipe to valve pipe adapter. Tighten and wire-lock coupling.

(9) Ensuring that bonding faces are clean, fit and secure bonding to transfer valve in accordance with DHS.645 (see Chapter 20).

(10) Check transfer valve control rigging (see Chapter 28, CONTROLS).

(11) Refuel long range tank (see Chapter 12, SERVICING - FUEL).

(12) Test long range tank fuel transfer (see Chapter 28, FUEL FEED SYSTEM).

(13) Check long range fuel transfer valve and pipe connections for leaks.

(14) Fit long range fuel transfer valve access panel.

* * *

# CONTROLS - ADJUSTMENT/TEST

**WARNING: IF A PART OF THIS SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, A FULL EXAMINATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT DISTORTION, TOOLS, RAGS, OTHER LOOSE OBJECTS OR UNWANTED MATERIAL THAT COULD PREVENT THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM ARE NOT PRESENT, AND THAT THE SYSTEMS AND INSTALLATIONS IN THE WORK AREA ARE CLEAN.**

**WARNING: IF A PART OF EITHER THE MAIN OR ANY ASSOCIATED SYSTEM IS DISASSEMBLED, ADJUSTED, REPAIRED OR REPLACED, THAT PART OF THE SYSTEM WHICH HAS BEEN CHANGED SHALL BE GIVEN AN ADDED INSPECTION FOR CORRECTLY INSTALLED LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

## 1. Adjustment/Test

| Equipment/Material | Part/Item No. |
|---|---|
| Tensiometer | Local supply |
| Rigging pins | Local supply |

### A. Rig the low-pressure fuel valve controls *(Figure 501)*

(1) Select the low-pressure fuel valve control lever to OFF.

(2) Align the rigging mark on the sprocket with the rigging mark on the sprocket mounting.

(3) Install the chain around the sprocket so the left hand end is 1.87 in. forward of the right hand end.

(4) Install the control cables. Tension equally to 25-30 lb. Make sure the rigging marks stay aligned.

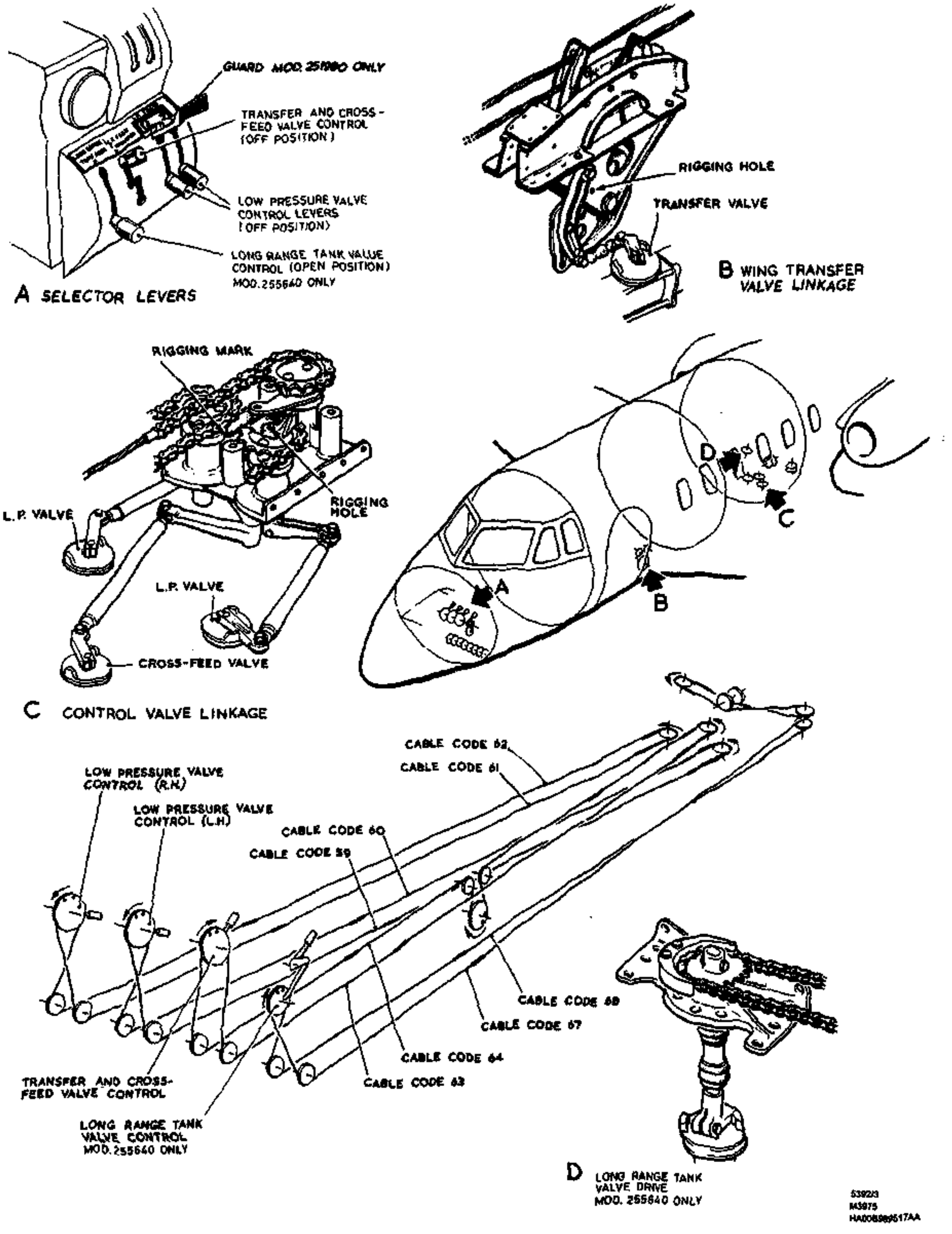
(5) Set the operating lever on the low-pressure valve against its closed stop.

*NOTE: The right hand low-pressure valve closed stop is the rear stop. The left hand valve closed stop is the forward stop.*

(6) Adjust and install the connecting rod between the operating lever and the lever on the sprocket spindle. Tighten the slotted nuts and safety with split pins.

(7) Do a check of all adjusters for safety. Tighten the locknuts and safety with lockwire.

(8) Do a check of the low-pressure fuel valve controls for full and free movement.


GUARD MOD. 251980 ONLY
TRANSFER AND CROSS-FEED VALVE CONTROL (OFF POSITION)
LOW PRESSURE VALVE CONTROL LEVERS (OFF POSITION)
LONG RANGE TANK VALUE CONTROL (OPEN POSITION) MOD.255640 ONLY
A SELECTOR LEVERS
RIGGING HOLE
TRANSFER VALVE
B WING TRANSFER VALVE LINKAGE
RIGGING MARK
RIGGING HOLE
L.P. VALVE
L.P. VALVE
CROSS-FEED VALVE
C CONTROL VALVE LINKAGE
D
C
A
B
CABLE CODE 62
CABLE CODE 61
LOW PRESSURE VALVE CONTROL (R.H.)
LOW PRESSURE VALVE CONTROL (L.H.)
CABLE CODE 60
CABLE CODE 59
CABLE CODE 68
CABLE CODE 67
CABLE CODE 64
CABLE CODE 63
TRANSFER AND CROSS-FEED VALVE CONTROL
LONG RANGE TANK VALVE CONTROL MOD.255640 ONLY
D LONG RANGE TANK VALVE DRIVE MOD. 255640 ONLY
5392/3
M3975
HA00B989517AA

Control valve cable routing

*Figure 501*

**B. Rig the cross-feed and wing transfer valve controls** *(Figure 501 and Figure 502)*

(1) Select the X-FEED/TRANSFER control lever to its fully down (TRANSFER) position.

(2) Insert a rigging pin through the transfer valve cable drum and the mounting bracket.

(3) Insert a rigging pin through the rigging plate on the sprocket and the rigging block on the sprocket mounting.

(4) Install the chain around the sprocket so the right hand end is 1.87 in. forward of the left hand end.

(5) Install the control cables. Tension equally to 25-30 lb.

(6) Make sure the cable tensions are equal by carefully removing rigging pins in turn and making sure the sprocket and pulley do not move. Re-install the rigging pins.

(7) Set the operating lever on the transfer valve against its open (forward) stop.

(8) Adjust and install the connecting rod between the fuel transfer valve operating lever and the cam-operated lever. Tighten the slotted nut(s) and install the split pin. Make sure that the connecting rod eye-ends are in safety and tighten the rod adjustment locknuts.

(a) Pre-mod.252590:
Safety and lockwire the rod through holes in eye-ends to hole in the barrel.

(b) Mod.252590:
Install pinned end of the connecting rod to transfer valve lever, tighten and lockwire both rod adjustment locknuts to hole in the barrel.

*NOTE: Mod.251385 Part B introduces a fuel transfer valve lever with the lower prong of the fork-end threaded, so deleting the attachment nut. When this type of lever is installed, the bolt is lockwireed to the locking tag under the spindle attachment bolt.*

(9) Set the crossfeed valve operating lever against its open (forward) stop.

(10) Adjust and install the connecting rod between the fuel crossfeed valve operating lever and the cam operated bell-crank lever. Tighten the slotted nuts and secure with split pins. Make sure the ends are in safety. Tighten the locknuts and safety the rod eye-ends with lockwire.

(11) Remove the rigging pins from the cable drum and the sprocket.

(12) Set the X-FEED/TRANSFER control lever to the gate (X-FEED) position. Make sure the crossfeed valve is in the open position and that the transfer valve is in the closed position.

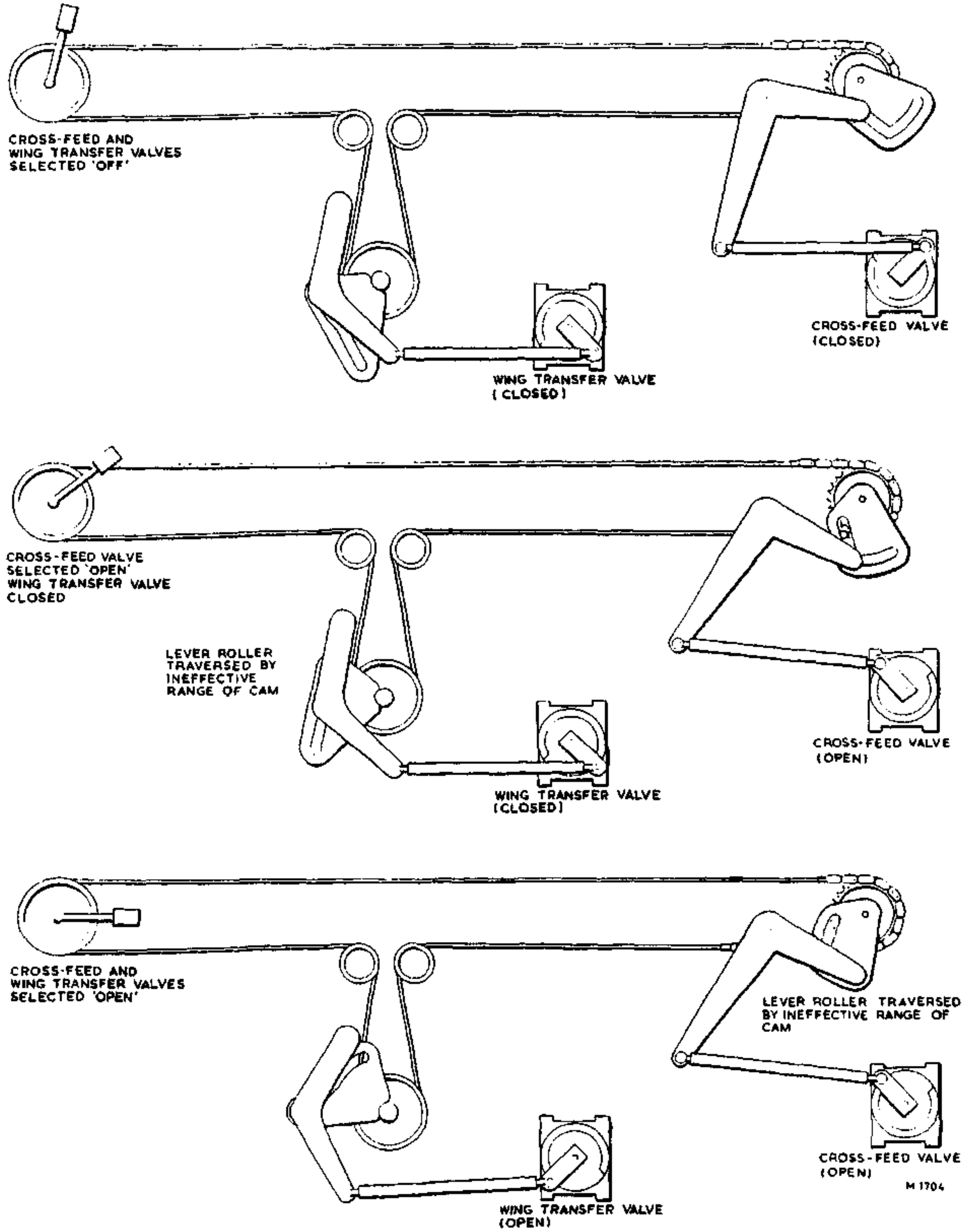
(13) Set the control lever to the fully up position. Make sure that both valves are closed.

(14) Do a check of all adjusters for safety, tighten and safety the locknuts with lockwire.

(15) Make sure that with the control lever at gate (crossfeed) position, indicator shows shut.

(16) Make sure that with the control at bottom of quadrant, the cam plate on pulley in control pedestal depresses the microswitch plunger and that indicator shows open.

(17) Do a check of the crossfeed and transfer valve controls for full and free movement.


CROSS-FEED AND WING TRANSFER VALVES SELECTED 'OFF'
CROSS-FEED VALVE (CLOSED)
WING TRANSFER VALVE (CLOSED)
CROSS-FEED VALVE SELECTED 'OPEN' WING TRANSFER VALVE CLOSED
LEVER ROLLER TRAVERSED BY INEFFECTIVE RANGE OF CAM
CROSS-FEED VALVE (OPEN)
WING TRANSFER VALVE (CLOSED)
CROSS-FEED AND WING TRANSFER VALVES SELECTED 'OPEN'
LEVER ROLLER TRAVERSED BY INEFFECTIVE RANGE OF CAM
CROSS-FEED VALVE (OPEN)
M 1704
WING TRANSFER VALVE (OPEN)

Crossfeed and wing transfer valve - operation

*Figure 502*

### C. Rig the long range tank fuel transfer valve

(1) Set the long range tank fuel transfer valve selector lever half-way between OFF and OPEN.

(2) With the long range tank fuel transfer valve connected to the sprocket drive shaft, position the valve half-way between open and closed and install the drive chain to the sprocket, so the chain ends are level, with the chain following the natural cable run. Install the cable guard.

(3) Route the control cables and connect to the cable drum and the drive chain.

(4) Set the long range tank fuel transfer valve selector lever to the OPEN position and make sure the lever knob engages with the hole in the quadrant. Tension the control cables evenly to 25-30 lb.

(5) Operate the long range tank fuel transfer valve lever and make sure the valve open and closed stops are contacted and that settings agree with the selected position of the lever.

(6) Make sure the cable turnbuckles are in safety, tighten the locknuts and safety the turnbuckles with lockwire.

(7) Adjust the long range tank OPEN microswitch as necessary (LONG RANGE TRANSFER VALVE MICROSWITCH).

(8) Do a check of the long range tank fuel transfer valve control for full and free range of movement.

## WING TRANSFER VALVE MICROSWITCH - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove wing transfer valve microswitch

(1) Isolate the microswitch electrical circuit (see Chapter 24, GENERAL).

(2) Remove the knobs from each of the four fuel control levers. Retain knobs complete with washers, spring retainers, springs and screws.

(3) Remove the slotted quadrant plate at the rear of the centre control pedestal.

(4) Slacken the two bolts securing the wing transfer valve microswitch to the pedestal frame, to remove microswitch.

(5) Disconnect the electrical cables from microswitch.

#### B. Install wing transfer valve microswitch

(1) Connect and secure the electrical cables to the microswitch.

(2) Fit microswitch to pedestal frame, tighten attachment bolts.

(3) Adjust wing transfer valve microswitch, see para. 2. A.

(4) Fit the slotted quadrant plate over fuel control levers, and secure with screws, to the centre control pedestal.

(5) Slide the fuel control lever knobs onto their respective levers, locate springs, spring retainers and washers. Fit and tighten knob securing screws.

(6) Operate each valve control lever in turn, and check that the spring loaded knobs engage with the recesses in quadrant plate, in all positions.

### 2. Adjustment/Test

#### A. Adjust wing transfer valve microswitch

(1) Isolate the wing transfer valve microswitch electrical circuit.

(2) Remove the knobs from each of the four fuel control levers. Retain knobs complete with washers, spring retainers, springs and screws.

(3) Remove the slotted quadrant plate at the rear of the control pedestal.

(4) Move the cross-feed and wing transfer valve lever until leading face of cam comes into contact with microswitch operating lever.

(5) Remove the split pins from the two nuts and bolts securing cam plate to cable drum. Slacken nuts.

...Wing transfer valve microswitch - Maintenance practices continued

(6) Restore the wing transfer valve microswitch electrical circuit and energize the P.E. busbar (see Chapter 24, GENERAL).

(7) Adjust cam so that microswitch 'makes' (indicated by magnetic indicator showing OPEN) approximately half way up cam face. Tighten nuts to secure cam plate.

(8) Move cross-feed and wing transfer valve lever to TRANSFER. Using a feeler gauge, check overtravel clearance between cam and microswitch lever is 0.015 in. minimum.

(9) De-energize the PE busbar (see Chapter 24, GENERAL) and isolate the wing transfer valve microswitch electrical circuit.

(10) Check nuts and bolts securing cam plate are tight, split pin nuts.

(11) Fit the slotted quadrant plate over fuel control levers, and secure with screws to the centre control pedestal.

(12) Slide the fuel control lever knobs onto their respective levers, locate springs, spring retainers and washers. Fit and tighten knob securing screws.

(13) Operate each valve control lever in turn and check that spring loaded knobs engage with the recesses in quadrant plate at all selections.

(14) Restore the wing transfer valve microswitch electrical circuit and energize the PE busbar (see Chapter 24, GENERAL).

(15) Select the fuel cross-feed and wing transfer valve control lever to OFF, X-FEED and TRANSFER. Check that the following indications are shown on the wing TRANSFER magnetic indicator :-

OFF - CLOSED
X-FEED - CLOSED
TRANSFER - OPEN

(16) De-energize the PE busbar (see Chapter 24, GENERAL).

* * *

# LONG RANGE TRANSFER VALVE MICROSWITCH - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove long range transfer valve microswitch

(1) Isolate the long range transfer valve microswitch electrical circuit.

(2) Remove the left-hand side panel from the centre control pedestal.

(3) Remove and retain upper stiffnut and lower bolt, securing microswitch

(4) Remove microswitch from eccentric stud.

(5) Disconnect microswitch electrical cables.

### B. Install long range transfer valve microswitch

(1) Connect and secure electrical cables to microswitch.

(2) Position microswitch on eccentric stud and fit stiffnut.

(3) Fit lower microswitch securing bolt.

(4) Adjust microswitch, see para. 2. A.

(5) Fit the left-hand side panel to centre control pedestal.

## 2. Adjustment/Test

### A. Adjust long range transfer valve microswitch

(1) Isolate the long range transfer valve microswitch electrical circuit.

(2) Remove the left-hand side panel from the centre control pedestal.

(3) Position the long range fuel transfer lever, until lever is 0.5 in. from the fully OPEN positon. In this position the microswitch roller should be approximately half-way up cam profile.

(4) Restore the long range transfer valve microswitch electrical circuit and energize the PE busbar (Chapter 24).

(5) Slacken the stiffnut and bolt securing microswitch.

(6) Rotate the adjusting washer at the rear of the microswitch, until the warning lamp on the roof panel lights.

(7) Tighten the stiffnut and bolt securing microswitch.

(8) Move the long range fuel transfer lever towards the SHUT position until the warning lamp goes out.

...Long range transfer valve microswitch - Maintenance practices continued

(9) Move the lever back towards OPEN until the lamp lights. Check that microswitch roller is approximately half way up cam profile.

(10) Move lever to fully OPEN, so that knob engages quadrant.

(11) Using a feeler gauge, check between roller and cam that the overtravel clearance is 0.015 in. minimum.

(12) Fit the left-hand side panel to the centre control pedestal.

(13) De-energize the PE busbar (see Chapter 24).

* * *

## APU FUEL PUMP - MAINTENANCE PRACTICES

### 1. Removal/Installation

A. Remove a.p.u. fuel pump (Fig.201)

(1) Isolate the fuel pump electrical circuit. (see Chapter 24).

(2) Gain access to the rear equipment bay.

(3) Disconnect the a.p.u. fuel pump gland drain pipe at the base of the cover.

(4) Carefully remove the pump and filter assembly cover, ensuring that the fuel pump and low pressure fuel switch electrical leads are not strained.

(5) Disconnect the electrical leads from the fuel pump.

(6) Remove bonding from the fuel supply pipe, pipe assembly, Avimo coupling and the non-return valve.

(7) Disconnect the fuel supply pipe at the fuel pump and filter assembly inlet.

(8) Disconnect the Avimo coupling between the pipe assembly and non-return valve, at the non-return valve inlet; discard the O-ring seal.

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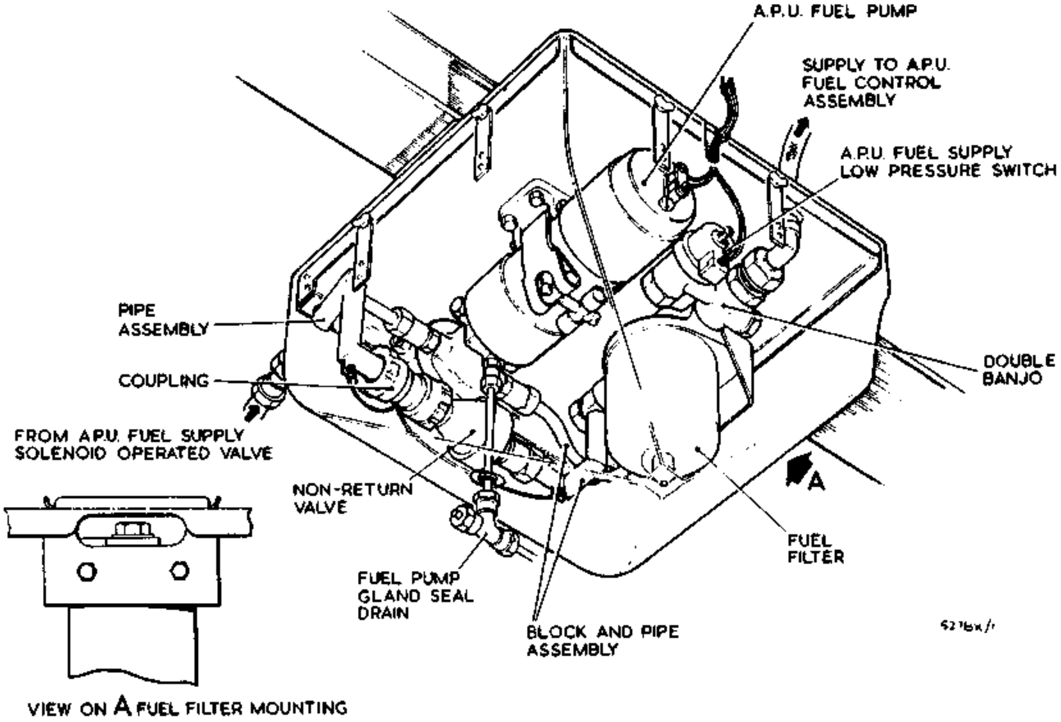
A.P.U. FUEL PUMP
SUPPLY TO A.P.U. FUEL CONTROL ASSEMBLY
A.P.U. FUEL SUPPLY LOW PRESSURE SWITCH
PIPE ASSEMBLY
COUPLING
DOUBLE BANJO
FROM A.P.U. FUEL SUPPLY SOLENOID OPERATED VALVE
NON-RETURN VALVE
A
FUEL FILTER
FUEL PUMP GLAND SEAL DRAIN
BLOCK AND PIPE ASSEMBLY
VIEW ON A FUEL FILTER MOUNTING

APU fuel pump - Installation
Fig.201

...APU fuel pump - Maintenance practices continued

(9) Disconnect and remove the pipe assembly from the fuel pump inlet.

(10) Disconnect the fuel pump outlet connection.

(11) Supporting the pump, remove the four bolts securing the pump saddle bracket to the mounting tray. Retain the bolts and washers.

(12) Disconnect the fuel pump gland seal drain pipe from the pump.

B. Install a.p.u. fuel pump

(1) Examine replacement pump for signs of external damage and remove transit blanks.

(2) Loosen the saddle bracket screw on the pump so that the pump may be turned in the bracket.

(3) Fit pump and saddle bracket to mounting tray and secure using the four attachment bolts and washers.

(4) Turn the pump until the outlet aligns with the block and pipe assembly union nut. Tighten and wire-lock saddle bracket screw and union nut.

(5) Fit and wire-lock the pump gland seal drain pipe.

(6) Locate the pipe assembly and loosely connect to pump inlet; ensure that the pipe grommet engages in pipe support bracket.

(7) Using a new O-ring seal, connect tighten and wire-lock the Avimo coupling between the pipe assembly and the non-return valve.

(8) Tighten and wire-lock the pipe assembly to the pump inlet, union nut.

(9) Connect, tighten and wire-lock the fuel supply pipe to the pipe assembly.

(10) Connect and secure bonding to the fuel supply pipe, pipe assembly, Avimo coupling and the non-return valve. Check that the resistance between pump and earth is not more than 0.05 ohm.

(11) Connect and secure the fuel pump electrical leads.

(12) Bleed the a.p.u. fuel feed system (see Chapter 28, APU FUEL FEED SYSTEM).

(13) Restore the fuel pump circuit and energize the d.c. busbars, open the No.1 engine low pressure fuel shut-off valve and select the a.p.u. MASTER switch ON; ensure that a.p.u. fuel pump runs, check the fuel pump assembly and associated pipes for leaks: Switch OFF the a.p.u. MASTER switch, close the No.1 engine low pressure fuel shut-off valve and de-energize the d.c. busbars.

...APU fuel pump - Maintenance practices continued

(14) Fit the a.p.u. fuel pump and filter assembly cover, fasten Dzus fasteners : Ensure that the fuel pump and fuel low pressure switch leads do not become trapped and that the grommet locates in cover slot.

(15) Connect tighten and wire-lock the a.p.u. fuel pump gland seal drain at the base of the cover.

* * *

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## APU FUEL FILTER - MAINTENANCE PRACTICES

### 1. Unit servicing

#### A. Change filter element

(1) Gain access to rear equipment bay.

(2) Disconnect the fuel pump gland seal drain, at the base of the a.p.u. pump and filter assembly cover.

(3) Carefully remove the pump and filter assembly cover ensuring that the fuel pump and pressure switch electrical leads are not strained.

(4) Support the filter container and with the spanner through the slot in the mounting tray, slacken the bolt securing the container. Remove and retain the container and coil spring.

(5) Withdraw the element mounting tube and filter element from the filter head. Retain tube and discard filter element.

(6) Remove and discard the filter head gasket; check that gasket groove is clean.

(7) Examine the O-ring seal in the shouldered end of the element mounting tube for damage; change if necessary.

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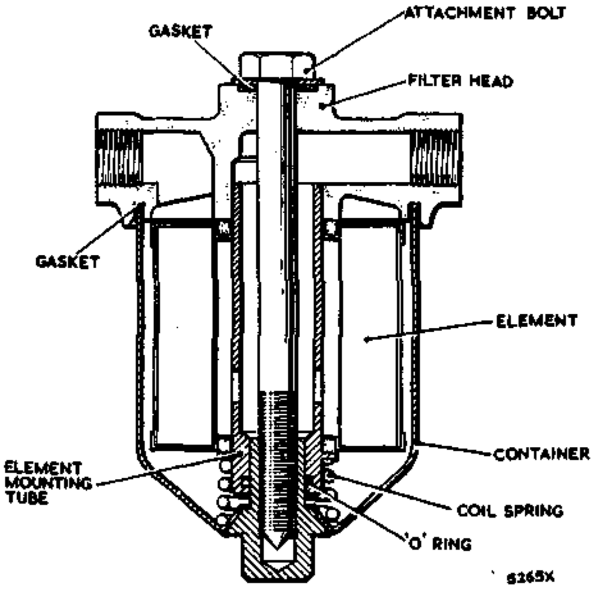

Fuel filter assembly
Fig.201

...APU fuel filter - Maintenance practices continued

(8) Fit a new gasket to the filter head.

(9) Check new filter element is clean and undamaged, position on element mounting tube and fit so that the tube locates in filter head, ensure that the element mounting tube O-ring seal is not damaged by container attachment bolt during this operation.

(10) Position coil spring in container, with the small end upwards. Place container over filter element, locate and tighten cover attachment bolt, wire-lock bolt to filter head.

(11) Bleed the a.p.u. fuel feed system (see Chapter 28, APU FUEL FEED SYSTEM).

(12) Energize the d.c. busbars, open the No.1 engine low pressure fuel shut-off valve and select the a.p.u. MASTER switch ON: Check, the fuel filter for leaks: Switch OFF the a.p.u. MASTER switch, close the No.1 engine low pressure fuel shut-off valve and de-energize the d.c. busbars.

(13) Fit the a.p.u. fuel pump and filter assembly cover, fasten Dzus fasteners : Ensure that the fuel pump and low pressure switch electrical leads do not become trapped and the grommet locates in cover slot.

(14) Connect,tighten and wire-lock the a.p.u. fuel pump gland seal drain at the base of the cover.

## 2. Removal/Installation

### A. Remove fuel filter

(1) Isolate fuel pressure switch electrical circuit (see Chapter 24, GENERAL).

(2) Gain access to the rear equipment bay.

(3) Disconnect the fuel pump gland seal drain at the base of the a.p.u. pump and filter assembly cover.

(4) Carefully remove the pump and filter assembly cover, ensuring that the fuel pump and pressure switch electrical leads are not strained.

(5) Disconnect the electrical leads from the fuel pressure switch.

(6) Disconnect the a.p.u. flexible supply hose from the fuel filter outlet banjo bolt.

(7) Remove the hollow banjo bolt from the filter outlet. Remove and retain the double banjo connection complete with pressure switch, discard the two sealing washers.

...APU fuel filter - Maintenance practices continued

(8) Remove the banjo bolt, securing block and pipe assembly to filter inlet; retain banjo bolt and discard the two sealing washers.

(9) Supporting the filter, remove the nuts and bolts securing the filter to the filter attachment bracket. Lower filter.

B. Install fuel filter

(1) Examine new filter for damage and remove transit blanks; ensure that an element is fitted and that the filter container securing bolt is tight and wire-locked.

(2) Fit the filter to the filter attachment bracket, and secure using the two bolts with stiffnuts.

(3) Secure the block and pipe assembly to the filter inlet, using the banjo bolt and two new sealing washers.

(4) Position the fuel low pressure switch and double banjo connection and secure to filter outlet using the hollow banjo bolt and two new sealing washers.

(5) Connect and secure the pressure switch electrical leads.

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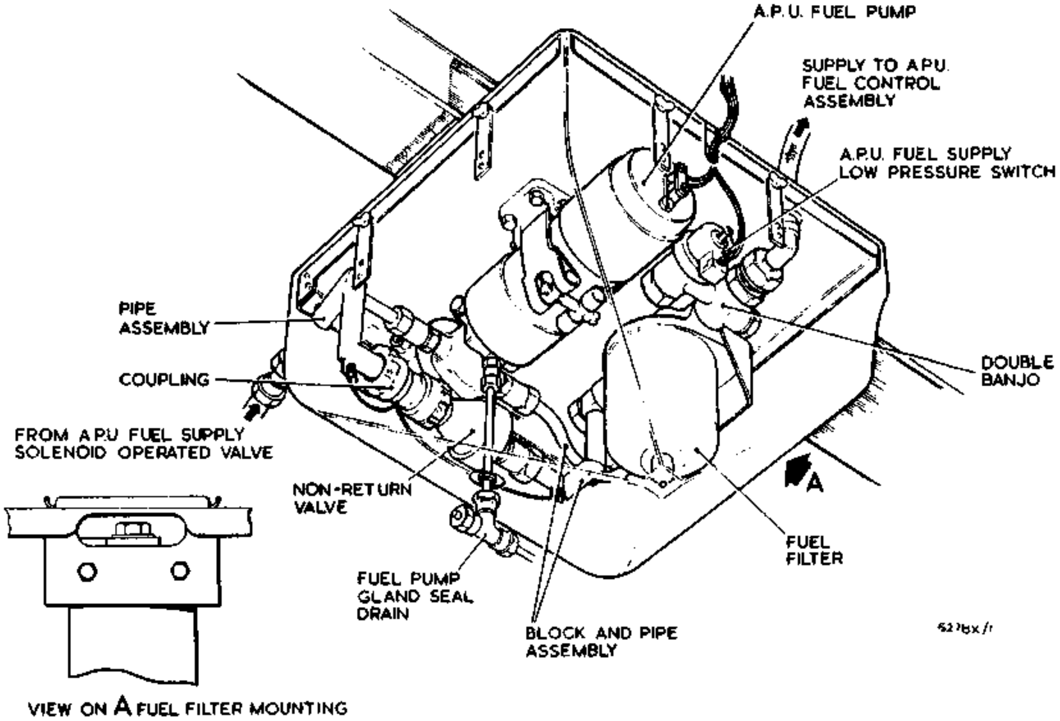
A.P.U. FUEL PUMP
SUPPLY TO A.P.U. FUEL CONTROL ASSEMBLY
A.P.U. FUEL SUPPLY LOW PRESSURE SWITCH
PIPE ASSEMBLY
COUPLING
DOUBLE BANJO
FROM A.P.U. FUEL SUPPLY SOLENOID OPERATED VALVE
A
NON-RETURN VALVE
FUEL FILTER
FUEL PUMP GLAND SEAL DRAIN
BLOCK AND PIPE ASSEMBLY
5276x/1
VIEW ON A FUEL FILTER MOUNTING

Fuel filter - Installation
Fig.202

...APU fuel filter - Maintenance practices continued

(6) Bleed the a.p.u. fuel feed system (see Chapter 28, APU FUEL FEED SYSTEM).

(7) Connect and secure the a.p.u. flexible supply hose to the filter outlet banjo bolt.

(8) Energize the d.c. busbars, open the No.1 engine low pressure fuel shut-off valve and select the a.p.u. MASTER switch ON: Check the fuel pump and filter assembly for leaks. Switch OFF the a.p.u. MASTER switch, close the No.1 engine low pressure fuel shut-off valve and de-energize the d.c. busbars.

(9) Wire-lock all pipe connections.

(10) Fit a.p.u. fuel pump and filter assembly cover, fasten the Dzus fasteners, ensuring that the fuel pump and pressure switch electrical leads do not become trapped and that the grommet locates in cover slot.

(11) Connect tighten and wire-lock the a.p.u. fuel pump gland seal drain at the base of the cover.

* * *

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## APU SOLENOID OPERATED VALVE - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove solenoid operated valve

Equipment required :-

Open fuel container

(1) Isolate the valve electrical circuit (see Chapter 24, GENERAL).

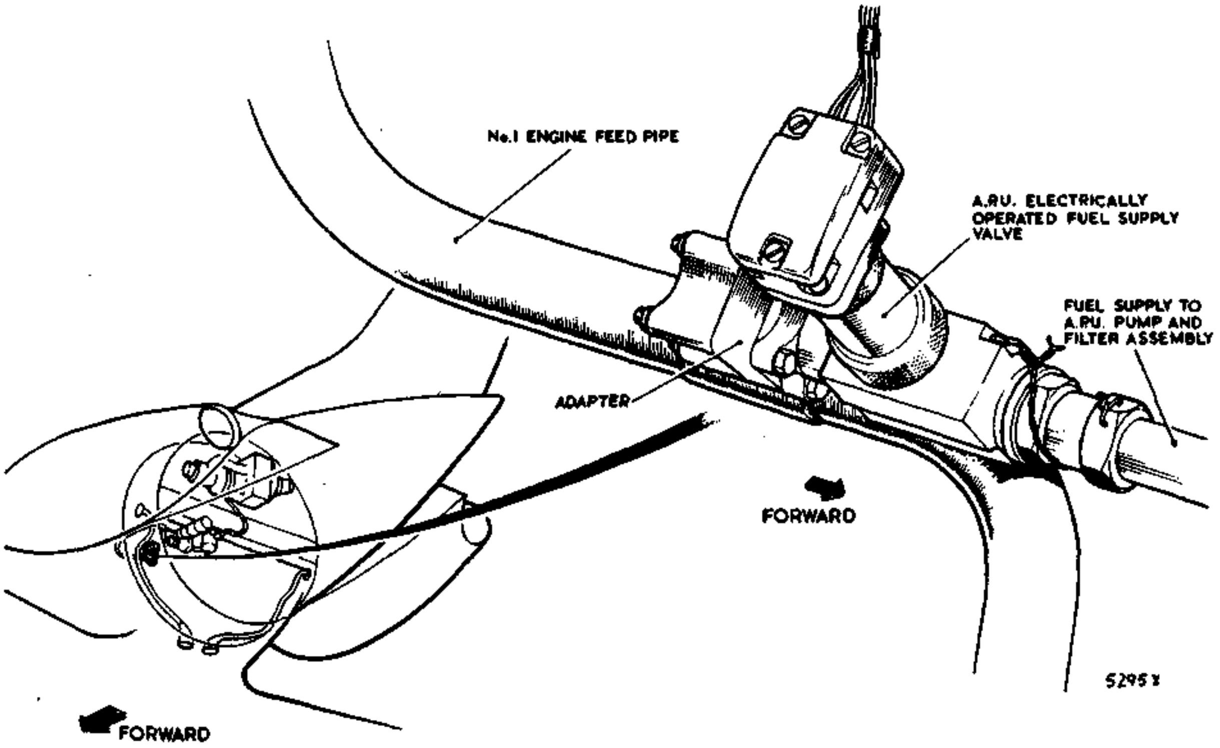
(2) Gain access to the rear equipment bay and position open fuel container below the solenoid operated valve.

(3) Disconnect the electrical leads from the solenoid operated valve terminal block.

(4) Remove and retain the bonding, between solenoid operated valve and pipelines.

(5) Disconnect the a.p.u. fuel feed pipe from the solenoid valve outlet.

(6) Remove the solenoid operated valve and its adapter from the No.1 engine fuel feed pipe. Discard the two O-ring seals and retain the bolts and adapter.


No.1 ENGINE FEED PIPE
A.P.U. ELECTRICALLY OPERATED FUEL SUPPLY VALVE
FUEL SUPPLY TO A.P.U. PUMP AND FILTER ASSEMBLY
ADAPTER
FORWARD
5295 x
FORWARD

Solenoid operated valve - Installation
Fig.201

B. Install solenoid operated valve

(1) Examine replacement solenoid operated valve for signs of damage. Remove transit blanks.

(2) Locate new O-ring seals in the valve adapter grooves. Fit solenoid operated valve and adapter to the No.1 engine fuel feed pipe. Tighten attachment bolts.

(3) Connect, tighten and wire-lock the a.p.u. fuel supply pipe to the solenoid operated valve outlet.

(4) Connect and secure the solenoid operated valve electrical leads to the valve terminals and the bonding flex between the valve and pipelines. Check that the resistance between valve and earth is not more than 0.05 ohms.

(5) Restore valve electrical circuit.

(6) Bleed the a.p.u. fuel feed system (see Chapter 28, APU FUEL FEED).

(7) Bleed the No.1 engine fuel feed system (see Chapter 73, GENERAL).

(8) Energize the d.c. busbars, open the No.1 engine low pressure fuel shut-off valve, select a.p.u. MASTER switch ON and switch ON the left-hand fuel booster pump.

(9) Examine for leaks from the solenoid operated valve inlet and outlet connections.

(10) Switch OFF the left-hand fuel booster pump and the a.p.u. MASTER switch, close the No.1 engine low pressure fuel shut-off valve and de-energize the d.c. busbars.

* * *

## APU FUEL PRESSURE SWITCH - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove a.p.u. pressure switch

(1) Isolate pressure switch electrical circuit (see Chapter 24, GENERAL).

(2) Gain access to the rear equipment bay.

(3) Disconnect the fuel pump gland seal drain, at the base of the a.p.u. fuel pump and filter assembly cover.

(4) Carefully remove the pump and filter assembly cover, ensuring that the fuel pump and pressure switch electrical leads are not strained.

(5) Remove the pressure switch, by removing the banjo bolt securing the pressure switch to the double banjo. Discard the O-ring seals.

(6) Disconnect the electrical leads from the pressure switch.

#### B. Install a.p.u. pressure switch

(1) Examine the new pressure switch for signs of external damage.

(2) Connect and secure the electrical leads to the pressure switch terminal block.

(3) Using new O-ring seals and the banjo bolt, fit and secure the pressure switch to the double banjo.

(4) Restore pressure switch electrical circuit.

(5) Bleed the a.p.u. fuel feed system (see Chapter 28, APU FUEL FEED SYSTEM). Check for leaks from pressure switch and banjo assembly.

(6) Wire-lock banjo bolt.

(7) Fit a.p.u. fuel pump and filter assembly cover, fasten the Dzus fasteners : Ensure that the fuel pump and pressure switch electrical leads do not become trapped and that grommet locates in slot.

(8) Connect, tighten and wire-lock the a.p.u. fuel pump gland seal drain at the base of the cover.

* * *

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## NON-RETURN VALVE (APU FUEL FEED SYSTEM) - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove non-return valve

(1) Gain access to the rear equipment bay.

(2) Disconnect the fuel pump gland seal drain at the base of the a.p.u. fuel pump and filter assembly cover.

(3) Carefully remove the pump and filter assembly cover, ensuring that the fuel pump and pressure switch electrical leads are not strained.

(4) Disconnect the bonding from the coupling, non-return valve and pipe assembly

(5) Disconnect the pipe union from the non-return valve inlet. Retain the adapter nipple.

(6) Slacken the non-return valve outlet coupling and remove non-return valve. Discard the O-ring seal.

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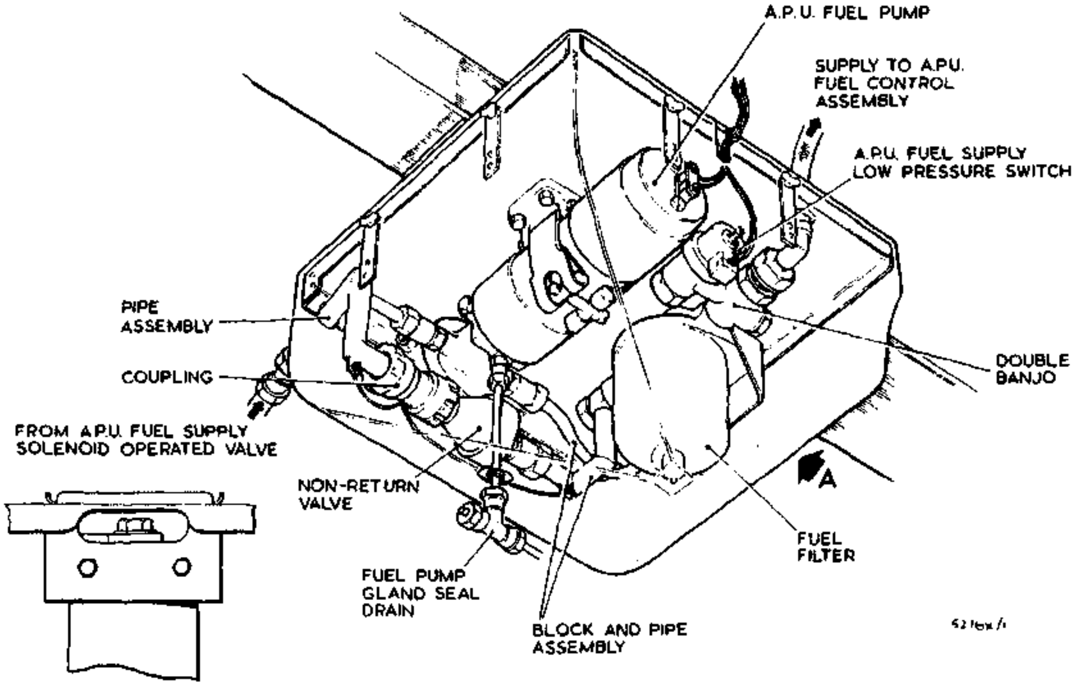
A.P.U. FUEL PUMP
SUPPLY TO A.P.U. FUEL CONTROL ASSEMBLY
A.P.U. FUEL SUPPLY LOW PRESSURE SWITCH
PIPE ASSEMBLY
COUPLING
DOUBLE BANJO
FROM A.P.U. FUEL SUPPLY SOLENOID OPERATED VALVE
A
NON-RETURN VALVE
FUEL FILTER
FUEL PUMP GLAND SEAL DRAIN
BLOCK AND PIPE ASSEMBLY
521ex/1
VIEW ON A FUEL FILTER MOUNTING

Non-return valve - Installation
Fig.201

B. Install non-return valve

(1) Examine new non-return valve for signs of external damage.

(2) Fit the nipple between the non-return valve and inlet pipe assembly. Connect pipe union.

(3) Using a new O-ring seal connect and secure the coupling to the non-return valve outlet.

(4) Bleed a.p.u. fuel feed system (see Chapter 28, APU FUEL FEED SYSTEM). Check non-return valve and connections for leaks.

(5) Wire-lock non-return valve connections and fit bonding between coupling, non-return valve and inlet pipe assembly.

(6) Fit a.p.u. fuel pump and filter assembly cover, fasten the Dzus fasteners : Ensure that the fuel pump and pressure switch electrical leads do not become trapped, and that the grommet locates in slot.

(7) Connect, tighten and wire-lock the a.p.u. fuel pump gland seal drain at the base of the cover.

* * *

# FUEL SUCTION PIPE AND STRAINER - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Removal of fuel suction pipe and strainer (Chap. 28-20-01, Fig.201).

NOTE : Owing to the restricting depth of the wing structure and location of the components in the structure, it may be necessary to undertake some operations using a mirror.

(1) Close the crossfeed, both low pressure shut-off and ventral tank transfer valves.

(2) Drain appropriate wing tank (see Chapter 12, SERVICING - FUEL).

(3) Remove No.1 compartment manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS) to gain access to the strainer. The strainer is located at the inlet of the fuel suction pipe assembly.

(4) Remove the nut and bolt to release the bonding flex from the fuel suction pipe lug.

(5) Remove the locking wire and unscrew the pipe coupling nut at the inlet to the NRV.

(6) Remove the two bolts securing the fuel suction pipe and strainer to the compartment floor. Withdraw the pipe and strainer assembly.

### B. Install fuel suction pipe and strainer (Chap. 28-20-01, Fig.201).

(1) Ensure fuel suction pipe and strainer assembly is clean and undamaged; check particularly the mesh is unbroken.

(2) Install the pipe and strainer into No.1 compartment, and secure with the two bolts. Check that a clearance exists between the strainer and wing skin.

(3) Assemble coupling nut compression ring and new sealing ring to the inlet of the NRV.

(4) Locate the NRV over the fuel suction pipe end and fully tighten the coupling nut.

(5) Wire lock the NRV coupling nut.

(6) Attach the bonding flex to the lug provided on the fuel suction pipe using the nut and bolt. Check bonding resistance in accordance with 20-20-645 (see Chapter 20, STANDARD PRACTICES).

(7) Fit No.1 compartment manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(8) Test fuel feed system through relevant engine disconnect point (see Chapter 28, FUEL FEED SYSTEM).

(9) When tank is refuelled, check there is no leakage at manhole cover.

* * *

## INDICATING

### 1. General

Indicators associated with the fuel systems are described earlier in this chapter in that section entitled *FUEL FEED SYSTEM (MAIN ENGINES)*.

* * *

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## DIP TUBE - MAINTENANCE PRACTICES

1. Removal/Installation

A. Remove dip tube

(1) Ensure that fuel tank is not more than half full.

(2) Remove countersunk bolts securing dip tube.

(3) Remove dip tube.

B. Install dip tube

(1) Clean off old sealant.

CAUTION : WHEN CLEANING FLANGE ENSURE THAT NO SEALANT FALLS INTO TANK.

IF SEALANT IS INADVERTENTLY DROPPED INTO THE TANK, CLOSE THE LOW-PRESSURE, CROSS-FEED AND TRANSFER VALVES, DRAIN ALL FUEL FROM THE APPROPRIATE TANK AND CLEAN THE TANK.

(2) Fit dip tube, sealing flange and underside of bolt heads with Thiokol (see Chapter 20).

(3) Tighten attachment bolts evenly.

* * *

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## FUEL CONTENTS INDICATING (CAPACITANCE SYSTEM) - DESCRIPTION AND OPERATION

### 1. Description

The Smiths Weymouth dielectric-type fuel contents gauge systems provide a continuous indication of the quantity of fuel in the tanks on two indicators in the flight compartment. Each system measures the capacitance of a set of tank units and their connecting coaxial cables, and presents a change of this capacitance as a measure of fuel quantity.

### 2. Operation

The tank units are open-ended concentric capacitors and are so positioned within the fuel tanks that, between certain limits, the value of capacitance measured is independent of aircraft attitude.

As fuel and air have different permittivities, and the tank units are open-ended tubes, changes in fuel level produce proportionate changes in capacitance. Each set of tank units is connected in parallel to a cable box which alters the empty and full tank capacitance to the values between which the amplifier operates; zero adjustment of the system is made possible by two trimmer capacitors in each cable box. The capacitance between the output terminals of the cable box forms part of an oscillator tuning circuit in the amplifier and change in tank capacitance therefore alters the frequency of oscillation. This frequency is passed through a frequency discriminator, a rectifier and an amplifier, and a d.c. output is provided as a function of oscillator frequency. The d.c. output operates a suitably calibrated moving-coil ammeter which thus indicates fuel quantity; the indicator has a current range of 2-7mA and is calibrated in pounds of fuel.

Location of the components in the system is shown on Fig.1. The amplifier is carried in an anti-vibration mounting which is held in a bracket bolted to the airframe.

Fig.1 overleaf

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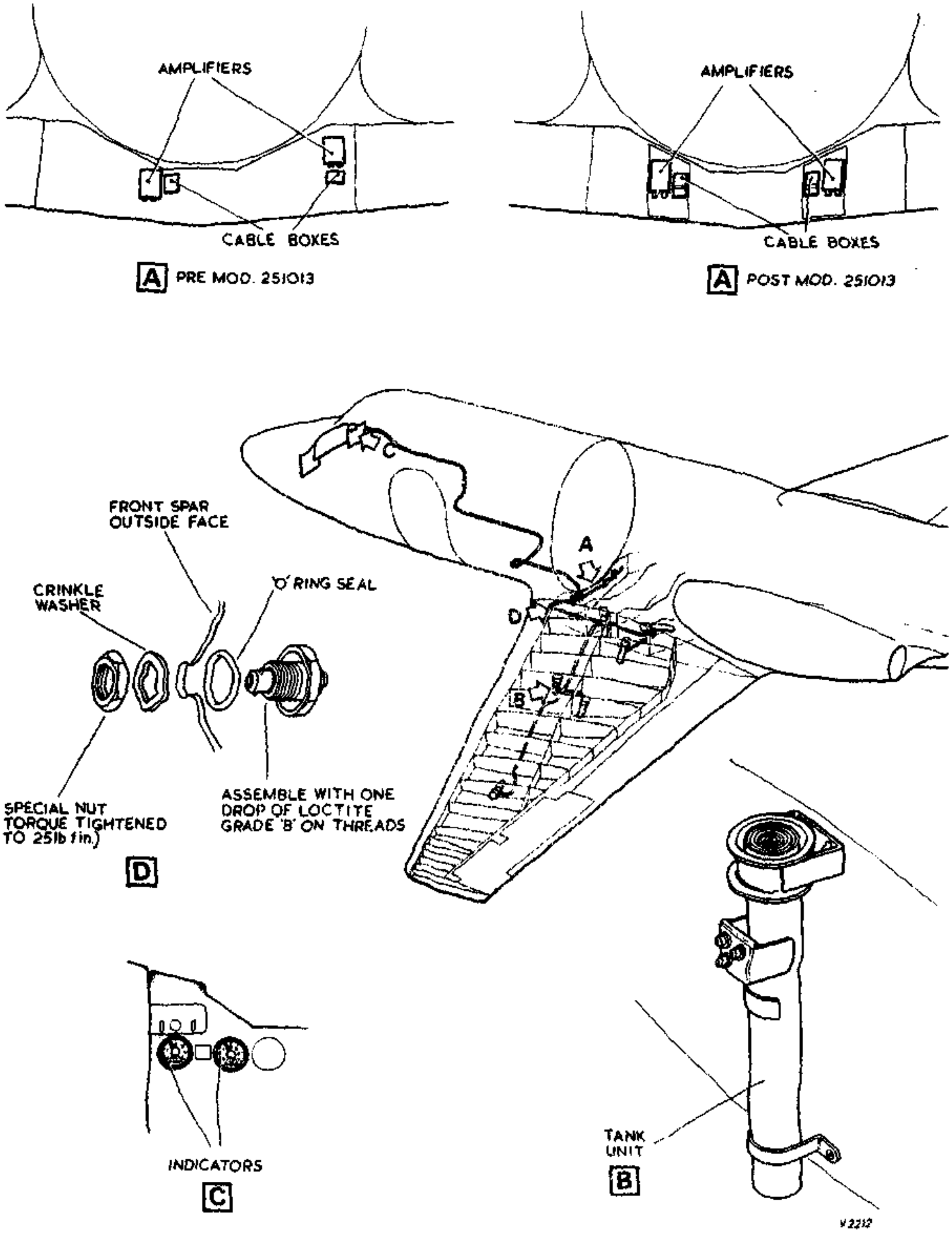

Layout of fuel contents system
Fig.1

## FUEL CONTENTS INDICATING (CAPACITANCE) SYSTEM TROUBLE SHOOTING

### 1. General

If a fuel contents system is suspect, the following trouble shooting procedures should be carried out using the Smiths QAA test set; the method of connecting the test set into the system, is given in the appropriate test (see MAINTENANCE PRACTICES).

The trouble shooting procedures are contained on three charts as follows :-

| | |
|---|---|
| Chart 101 - | Indicator, amplifier and cabling. |
| Chart 102 - | Cable box and co-axial cables, between tank terminal and amplifier. |
| Chart 103 - | Tank units and associated co-axial cables, within the tank. |

It is unnecessary to drain the fuel tanks when following Chart 101 but, before proceeding with Chart 102, the aircraft must be rigged level, and the fuel tanks drained to fuel drain valve level.

Before attempting the tests on Chart 103, the aircraft must be rigged level, the fuel tanks drained to water drain valve level, opened and purged of fuel fumes (see Chapter 12, SERVICING-FUEL and Chapter 28, TANKS).

Where reference is made to Tests A (1), B (1), C (1) etc. these tests refer to the paragraphs and operations of Adjustment/Test (see MAINTENANCE PRACTICES).

When a component has been isolated using these trouble shooting procedures, it should be removed in accordance with the Removal/Installation procedures (see MAINTENANCE PRACTICES) and then be subjected to the tests laid down in the relevant OVERHAUL MANUAL, before discarding as unserviceable. Particular attention must be paid when installing a component to ensure that the relevant tests, called for in the installation operations, are carried out.

Charts 101-103 overleaf

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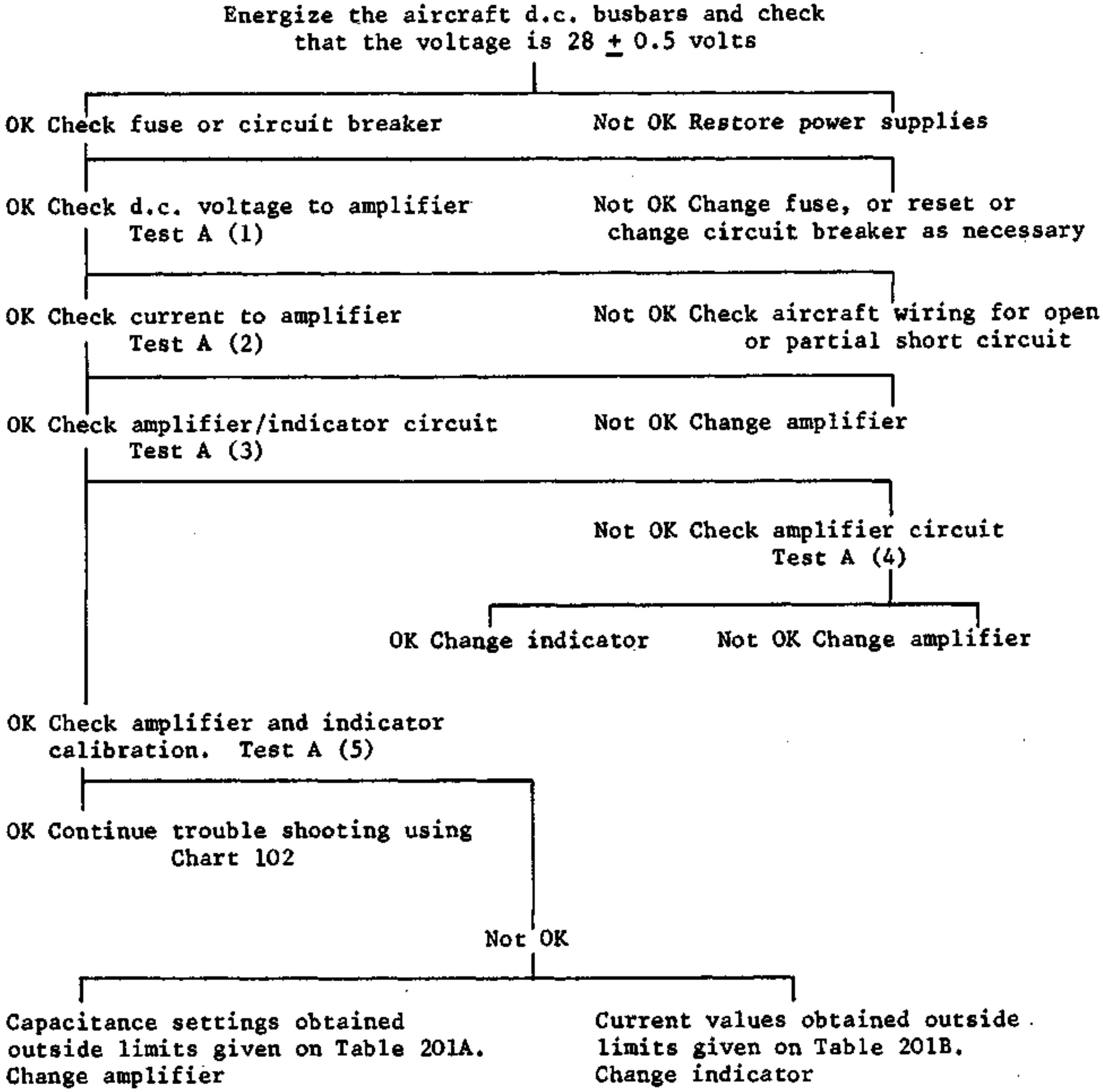
...Fuel contents indicating (capacitance) system - Trouble shooting continued

## INACCURATE OR ZERO READING ON CONTENTS INDICATOR



Energize the aircraft d.c. busbars and check that the voltage is 28 ± 0.5 volts

OK Check fuse or circuit breaker

Not OK Restore power supplies

OK Check d.c. voltage to amplifier Test A (1)

Not OK Change fuse, or reset or change circuit breaker as necessary

OK Check current to amplifier Test A (2)

Not OK Check aircraft wiring for open or partial short circuit

OK Check amplifier/indicator circuit Test A (3)

Not OK Change amplifier

Not OK Check amplifier circuit Test A (4)

OK Change indicator

Not OK Change amplifier

OK Check amplifier and indicator calibration. Test A (5)

OK Continue trouble shooting using Chart 102

Not OK

Capacitance settings obtained outside limits given on Table 201A. Change amplifier

Current values obtained outside limits given on Table 201B. Change indicator

Chart 101

INACCURATE OR ZERO READING ON CONTENTS INDICATOR(continued)

NOTE : Before proceeding with the tests in this Chart, defuel the tanks, rig aircraft level, and drain tanks to fuel drain valve level (see Chapter 12).

Test cable MCK 9. Test B (1)

OK Test cable box. Test B (2)

Not OK Change cable box MCK9

OK Test cable *MCK 47. Test B (3)

Not OK Adjust cable box trimmer to obtain a reading within the limits of Test B (2). If outside range of trimmer change box.

OK Continue trouble shooting using chart 103.

Not OK Change cable MCK 47

*NOTES : (1) MCK 47 (pre Mod.252763), MCK-A-45 (Mod.252763)
(2) Cable MCK-A.45 is superseded by cable MCK.B.45 post Mod.252858.

Chart 102

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...Fuel contents indicating (capacitance system) - Maintenance practices continued

INACCURATE OR ZERO READING ON CONTENTS INDICATOR (continued)

NOTE : 1. Before proceeding with the tests in this Chart, defuel the tanks, rig aircraft level, drain tanks to water drain valve level, open tanks and purge of fuel fumes (see Chapter 12 and TANK - MAINTENANCE PRACTICES).

2. If the fuel indicator reading is reported as fluctuating erratically during certain flight conditions, but is not present on ground investigation utilizing fault finding Chart 103, check that MB54 bulkhead adapter is secure and nut is torque loaded to 25 lbf in.

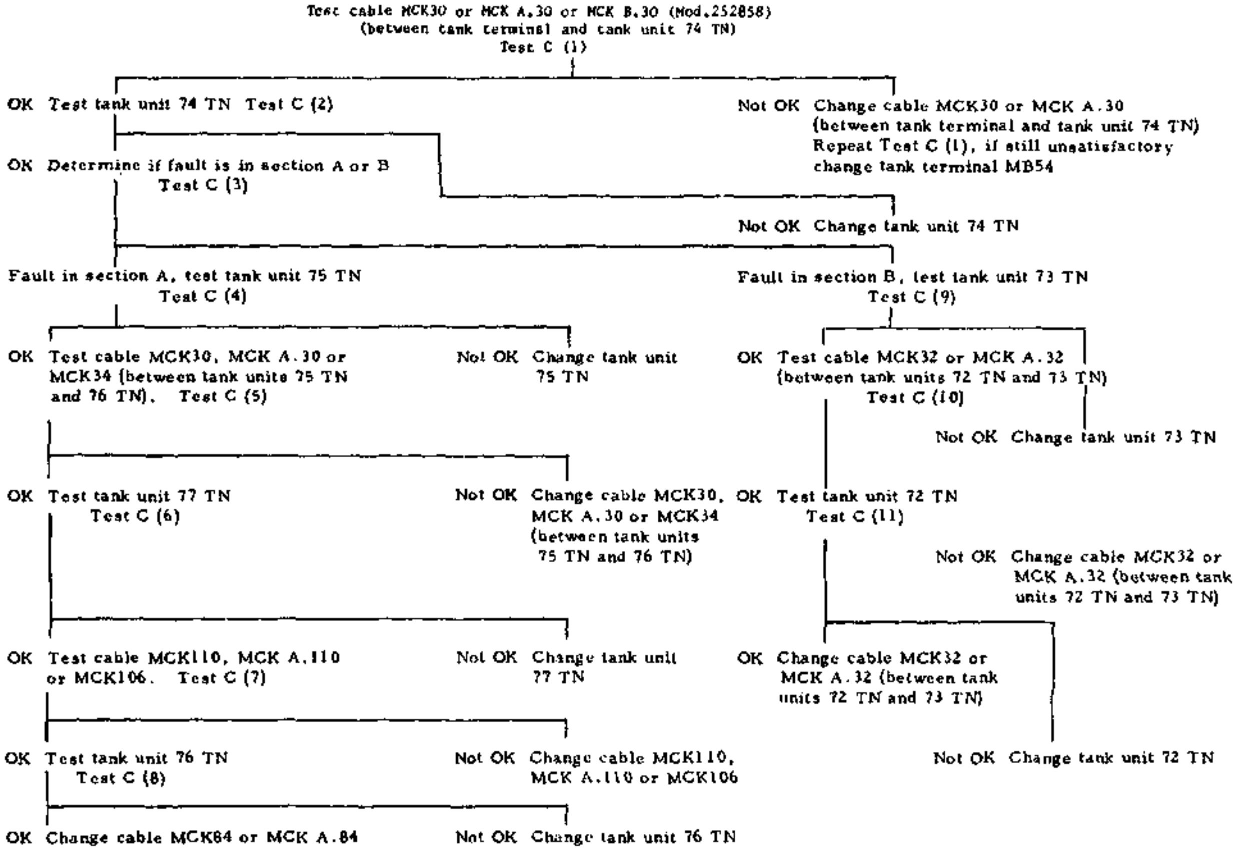
Test cable MCK30 or MCK A.30 or MCK B.30 (Mod.252858) (between tank terminal and tank unit 74 TN) Test C (1)
OK Test tank unit 74 TN Test C (2)
Not OK Change cable MCK30 or MCK A.30 (between tank terminal and tank unit 74 TN) Repeat Test C (1), if still unsatisfactory change tank terminal MB54
OK Determine if fault is in section A or B Test C (3)
Not OK Change tank unit 74 TN
Fault in section A, test tank unit 75 TN Test C (4)
Fault in section B, test tank unit 73 TN Test C (9)
OK Test cable MCK30, MCK A.30 or MCK34 (between tank units 75 TN and 76 TN). Test C (5)
Not OK Change tank unit 75 TN
OK Test cable MCK32 or MCK A.32 (between tank units 72 TN and 73 TN) Test C (10)
Not OK Change tank unit 73 TN
OK Test tank unit 77 TN Test C (6)
Not OK Change cable MCK30, MCK A.30 or MCK34 (between tank units 75 TN and 76 TN)
OK Test tank unit 72 TN Test C (11)
Not OK Change cable MCK32 or MCK A.32 (between tank units 72 TN and 73 TN)
OK Test cable MCK110, MCK A.110 or MCK106. Test C (7)
Not OK Change tank unit 77 TN
OK Change cable MCK32 or MCK A.32 (between tank units 72 TN and 73 TN)
OK Test tank unit 76 TN Test C (8)
Not OK Change cable MCK110, MCK A.110 or MCK106
Not OK Change tank unit 72 TN
OK Change cable MCK84 or MCK A.84
Not OK Change tank unit 76 TN

Chart 103

* * *

## FUEL CONTENTS INDICATING (CAPACITANCE SYSTEM)
## MAINTENANCE PRACTICES

### 1. Adjustment/Test

A. Test amplifier and indicator (Fig.201)

Equipment required :-

Smith's QAA test set, with adapter CGA109 and cables CE1, CG144, CGA110 and CGA111.

NOTES : 1. If during the following tests, the readings obtained are not within the tolerances given, refer to the appropriate test reference on Chart 101 of TROUBLE SHOOTING, and rectify as indicated.

2. If a defect is discovered during a test, switch OFF the test set, and de-energize the aircraft d.c. busbars. Remove the suspect component, and test in accordance with the relevant OVERHAUL MANUAL.

3. On completion of any rectification, repeat the test which located the defective component, and then disconnect the test set cables, reconnect the system cables and test the system as detailed in operation (6).

(1) D.C. supply to amplifier test :-

(a) Connect the 6-way socket of cable CG144 to the test set plug.
(b) Disconnect aircraft cable socket from amplifier.
(c) Connect cable CGA111 to amplifier and to cable CG144.
(d) Connect cable CGA110 to aircraft cable socket and to cable C9144.
(e) Energize the aircraft d.c. busbars (see Chapter 24, GENERAL).
(f) Set test set meter ON/OFF switch to ON; wait five minutes for the amplifier to warm up.
(g) Set test set selector switch to position 1; test set indicator should read 28 ± 0.5 volts on the inner scale.

(2) Amplifier current test :-

(a) Set test set selector switch to position 2; test set indicator should read 0.6 to 0.75 amps for pre-mod. 257229 amplifiers, or 0.4 to 0.5 amps for mod.257229 amplifiers.

NOTE : Mod.257229 (Smith's mod.10 to amplifier type FAB28, or mod.02 to amplifier type FAB 30) introduces an improved type of valve. Check amplifier data and mod. plates to determine which current values apply.

(3) Amplifier and indicator circuit test :-
Set test set selector switch to position 3; test set indicator should read between 2mA to 7mA on outer scale depending on aircraft fuel state.

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...Fuel contents indicating (capacitance system) - Maintenance practices continued

(4) Amplifier circuit test :-
Set test set selector switch to position 4; test set indicator should read between 2mA to 7mA on outer scale depending on aircraft fuel state.

(5) Amplifier and indicator calibration test :-

(a) Connect cable CE1 to one of the test set co-axial sockets.
(b) Connect adapter CGA109 to cable CE1.
(c) Disconnect cable MCK9 from amplifier, and connect CGA 109 adapter branch socket to amplifier (TP1). Leave plug branch of adapter CGA 109 disconnected.
(d) Set test set selector switch to position 3.
(e) Set test set capacitance selector and variable capacitor progressively to obtain, on the test set indicator, the current values given in Table 201 A; check at each stage, that the total test set capacitance (capacitance selector and variable capacitor values) is within the tolerance given.
(f) Set test set capacitance selector and variable capacitor progressively to give , on the test set indicator, the readings shown on Table 201B; check at each stage, that aircraft contents indicator agrees with figures given.

Table 201

| A | | B | |
|---|---|---|---|
| Test set indicator reading mA | Test set capacitance pF | Test set indicator reading mA | Aircraft indicator reading lb x 1000 |
| 2.0 | 560 ± 8 | 2.00 ± 0.1 | 0 * |
| 5.0 | 815 ± 10 | 2.76 ± 0.1 | 0.5 |
| 7.0 | 1060 ± 10 | 3.33 ± 0.1 | 1.0 |
| | | 4.41 ± 0.1 | 2.0 |
| | | 5.27 ± 0.1 | 3.0 |
| | | 6.16 ± 0.1 | 4.0 |
| | | 7.00 ± 0.1 | 5.0 |

* The zero mark on type 13AG indicator is at the lower end of the yellow block.

NOTE If the tests detailed in para. 1.B. are to be carried out, ignore operation (6)

(6) (a) Switch OFF test set, de-energize the aircraft d.c. busbars (see Chapter 24, GENERAL) and disconnect cables CGA110, CGA111 and CG144, from the aircraft cable and amplifier.
Connect and secure the aircraft cable socket to the amplifier.
(b) Disconnect cable CE1 and adapter CGA109 from amplifier. Connect and secure the MCK9 cable socket to the amplifier.
(c) Trim fuel contents indicator, see para. 1.D.

...Fuel contents indicating (capacitance system) - Maintenance practices continued

B. Test system circuit between tank terminal and amplifier (Fig.201)

Equipment required :-

Smith's QAA test set, with adapter CGA109 and cables CE1, CG144, CGA110 and CGA111.

NOTES : 1. Before attempting these tests, rig the aircraft level and drain the tank(s) to fuel drain valve level (see Chapter 12).

2. If during the following tests the capacitance values obtained are not within the tolerances given, refer to the appropriate test reference on Chart 102 of TROUBLE SHOOTING and rectify as necessary.

3. If a defect is discovered during a test, switch OFF the test set, and de-energize the aircraft d.c. busbars. Remove the suspect component and test in accordance with the relevant OVERHAUL MANUAL.

4. On completion of any rectification, repeat the test which located the defective component, and then disconnect the test set cables, reconnect the system cables and test the system as detailed in operation (4).

5. Cable MCK47 is replaced by cable MCK-A-45 on Mod.252763. Mod.252858 changes cable MCK-A-45 to MCK-B-45.

(1) Cable MCK9 test :-

(a) Connect test set into system as in para. 1.A.(1) (a) to (f).

(b) If the test detailed in para.1.A.(5) has been carried out prior to this test, disconnect the CGA109 adapter socket from the amplifier and reconnect MCK9 cable socket to the amplifier plug.

(c) Disconnect the MCK9 cable socket from the cable box AMP plug. With cable CE1 and adapter CGA109 connected to the test set, connect adapter plug to MCK9 cable socket (TP2). Leave the CGA109 adapter socket disconnected.

(d) Set test set selector switch to position 3.

(e) Vary test set capacitance selector and variable capacitor until test set indicator reads 2mA; test set capacitance should be 539 ± 11 pF.

(2) Cable box test :-

(a) Disconnect CGA109 adapter plug from the MCK9 cable socket and connect the MCK9 cable socket to the cable box AMP plug.

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...Fuel contents indicating (capacitance system) - Maintenance practices continued

(b) Disconnect cable MCK47 (see NOTE 5) from the cable box TANK plug and connect the CGA109 adapter socket to the cable box TANK plug (TP3). Leave the CGA109 adapter plug disconnected.

(c) Vary test set capacitance selector and variable capacitor until test set indicator reads 2mA; test set capacitance should be 1488 ± 110 pF pre-Mod.257181, or 1528 ± 110 pF with Mod.257181 incorporated.

(3) Cable MCK47 (see NOTE 5) test :-

(a) Disconnect the CGA109 adapter socket from the cable box TANK plug, and connect the MCK47 (see NOTE 5) cable to the cable box TANK plug.

(b) Disconnect the MCK47 (see NOTE 5) cable socket from the MB54 tank terminal plug and connect the CGA109 adapter plug to the disconnected MCK47 (see NOTE 5) cable socket (TP4). Leave the CGA109 adapter socket disconnected.

(c) Vary test set capacitance selector and variable capacitor until the test set indicator reads 2mA; test set capacitance should be 1378 ± 99 pF pre Mod.257181, or 1418 ± 99 pF with Mod.257181 incorporated.

NOTE : If the tests detailed in 1.C are to be carried out ignore operation (4).

(4) (a) Switch OFF test set de-energize the aircraft d.c. busbars (see Chapter 24, GENERAL) and disconnect cables CGA110, CGA111 and CG144 from the aircraft cable and the amplifier. Connect and secure the aircrft cable socket to the amplifier plug.

(b) Disconnect cable CE1 and the CGA109 adapter plug from the MCK47 (see NOTE 5) cable socket and connect the MCK47 (see NOTE 5) cable socket to the MB54 tank terminal plug.

(c) Trim fuel contents indicator, see para.1.D.

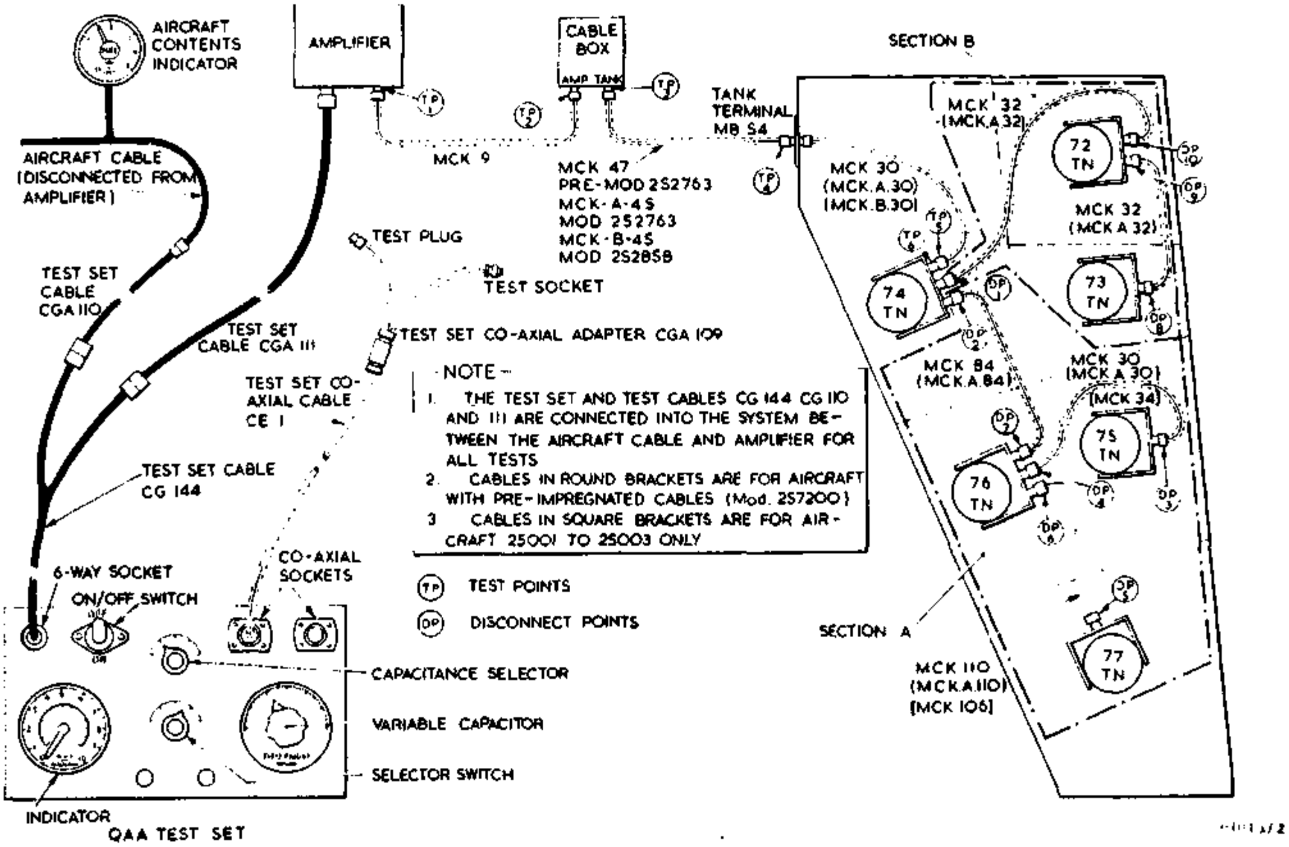
## C. Test system tank components (installed in tank) (Fig.201)

Equipment required :-

Smith's AQQ test set, with adapter CGA109 and cables CE1, CG144, CG110 and CGA111.

NOTES : 1. Before attempting these tests, rig the aircraft level, drain tank(s) to water drain valve level and purge of fuel fumes (see Chapter 28, TANKS).

...Fuel contents indicating (capacitance system) - Maintenance practices continued



-NOTE-

1. THE TEST SET AND TEST CABLES CG 144 CG 110 AND 111 ARE CONNECTED INTO THE SYSTEM BETWEEN THE AIRCRAFT CABLE AND AMPLIFIER FOR ALL TESTS
2. CABLES IN ROUND BRACKETS ARE FOR AIRCRAFT WITH PRE-IMPREGNATED CABLES (Mod. 257200)
3. CABLES IN SQUARE BRACKETS ARE FOR AIRCRAFT 25001 TO 25003 ONLY

Test and disconnection points
Fig.201

2. If during these tests, the capacitance values obtained are not within the tolerances given, refer to the appropriate test reference on Chart 103 of TROUBLE SHOOTING and rectify as indicated.

3. If a defect is discovered during a test, switch OFF the test set, and de-energize the aircraft d.c. busbars. Remove the suspect component and test in accordance with the relevant OVERHAUL MANUAL.

4. On completion of any rectification, repeat the test which located the defective component, and then disconnect the test set cables, reconnect the system cables and test the system as detailed in operation C.(12).

5. Cable MCK47 is replaced by cable MCK-A-45 on Mod.252763. Mod.252858 changes cable MCK-A-45 to MCK-B-45.

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...Fuel contents indicating (capacitance system) - Maintenance practices continued

(1) Test cable MCK30 or MCK A.30 or MCK B.30 (Mod.252858) (between tank terminal MB54 and tank unit 74TN):

(a) Connect test set into system as in para. 1.A.(1) (a) to (f).

(b) If the test detailed in para. 1.B.(3) was carried out prior to this test, disconnect the CGA109 adapter plug from the MCK47 (see NOTE 5) cable socket, and connect the MCK47 (see NOTE 5) cable socket, to the MB54 tank terminal plug.

(c) Disconnect cable MCK30, or MCK A.30 or MCK B.30 (Mod.252858) from tank unit 74TN. With cable CE1 and adapter CGA109 connected to the test set, connect adapter plug to the disconnected MCK30 or MCK A.30 or MCK B.30 (Mod.252858) cable socket (TP5). Leave the CGA109 adapter socket disconnected.

(d) Set test set selector to position 3.

(e) Vary test set capacitance selector and variable capacitor until test set indicator reads 2mA; test set capacitance should be 1306 ± 92 pF pre Mods 257181 and 257200, or 1341 ± 92 pF with Mods 257181 and 257200 incorporated.

(2) Test tank unit 74TN :-

(a) Disconnect cables MCK32 or MCK.A.32 (between tank units 72TN and 74TN) and MCK84 or MCK.A.84 from tank unit 74TN (DP1 and DP2). Connect CGA109 adapter socket to tank unit 74TN plug (TP6). The CGA109 adapter plug must remain connected to the MCK30 or MCK.A.30 cable socket.

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 2mA; test set capacitance should be 1107 ± 90 pF pre Mods 25181 and 257200 or 1142 ± 90 pF with Mods 257181 and Mods 257181 and 257200 incorporated.

NOTE : If during the following tests, a current reading is unobtainable, follow the test disconnection procedures until the defective component is isolated.

(3) Test to determine if a fault exists in sections A or B (see Fig.201):-

(a) Connect cable MCK32 or MCK.A.32 to tank unit 74TN. Leave cable MCK84 or MCK.A.84 disconnected.

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance.

(c) Disconnect cable MCK32 or MCK.A.32 from tank unit 74TN (DP1) and connect cable MCK84 or MCK.A.84 to tank unit 74TN (DP2).

(d) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance.

(e) Connect cable MCK32 or MCK.A.32 to tank unit 74TN(DP1).

(f) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance.

(g) Calculate difference in capacitance values obtained in sub-paras (b) and (f); this should be 975 ± 59 pF pre Mod. 257200, or 1001 ± 60 pF with Mod. 257200 embodied. If this value is not obtained, a fault exists in section A.

(h) Calculate difference in capacitance values obtained in sub-paras (d) and (f); this should be 318 ± 19 pF pre Mod. 257200, or 326 ± 19 pF with Mod. 257200 embodied. If this value is not obtained, a fault exists in section B.

NOTE : If both sections A and B are satisfactory, ignore operations (4) to (11) but complete operation (12). If a fault exists in section A, complete operations (4) to (8) and (12). For a fault in section B, ignore operations (4) to (8), but complete operations (9) to (12).

(4) Test tank unit 75TN :-

(a) Disconnect cable MCK30, MCK.A.30 or MCK34 (between tank units 75TN and 76TN) from tank unit 75TN (DP3).

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in operation (3) (f) should be 163 ± 2pF.

(5) Test cable MCK30, MCK.A.30, or MCK34 (between tank units 75TN and 76TN) :-

(a) Connect cable MCK30, MCK.A.30, or MCK34 to tank unit 75TN, and disconnect from tank unit 76TN(DP4).

(b) Vary test set capacitance selector and variable capacitor, until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in

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...Fuel contents indicating (capacitance system) - Maintenance practices continued

operation (3) (f) should be (depending on type of cable fitted) as follows :-

Cable MCK30 ... 233 ± 9 pF.
Cable MCK.A.30 ... 238 ± 9 pF
Cable MCK34 ... 242 ± 11 pF

(6) Test tank unit 77TN :-

(a) Connect cable MCK30, MCK.A.30, or MCK34 to tank unit 76TN, and disconnect cable MCK110, MCK.A.110, or MCK106 from tank unit 77TN (DP5).

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in operation (3) (f) should be 142 ± 2 pF.

(7) Test cable MCK110, MCK.A.110, or MCK106 :-

(a) Connect cable MCK110, MCK/A.110, or MCK106 to tank unit 77TN and disconnect cable MCK110, MCK.A.110 or MCK.106 from tank unit 76TN (DP6).

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in operation (3) (f) should be (depending on type of cable fitted) as follows :-

Cable MCK110 ... 397 ± 28 pF.
Cable MCK.A.110 ... 410 ± 29 pF.
Cable MCK106 ... 388 ± 27 pF.

(8) Test tank unit 76TN :-

(a) Connect cable MCK110, MCK.A.110, or MCK106 to tank unit 76TN and disconnect cable MCK84 or MCK.A.84 from tank unit 76TN (DP7).

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in operation (3) (f) should be depending on type of cables fitted) as follows :-

Cables MCK110 and MCK30, or MCK106 and MCK34 ... 779 ± 39 pF.
Cables MCK.A.110 and MCK.A.30 ... ... ... 797 ± 40 pF.

...Fuel contents indicating (capacitance system) - Maintenance practices continued

(c) Connect cable MCK84 or MCK.A.84 to tank unit 76TN.

(9) Test tank unit 73TN :-

(a) Disconnect cable MCK 32 or MCK.A.32 (between tank units 72TN and 73TN) from tank unit 73TN (DP8).

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in operation (3) (f) should be 66 ± 1 pF.

(10) Test cable MCK32 or MCK.A.32 (between tank units 72TN and 73TN) :-

(a) Connect cable MCK32 or MCK.A.32 to tank unit 73TN and disconnect from tank unit 72TN (DP9).

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in operation (3) (f) should be (depending on type of cable fitted) as follows :-

| | | |
|---|---|---|
| Cable MCK32 | ... | 141 ± 9 pF. |
| Cable MCK.A.32 | ... | 145 ± 9 pF. |

(11) Test tank unit 72TN :-

(a) Connect cable MCK32 or MCK.A.32 (between tank units 72TN and 73TN) to tank unit 72TN, and disconnect cable MCK32 or MCK.A.32 (between tank units 72TN and 74TN) from tank unit 72TN (DP10).

(b) Vary test set capacitance selector and variable capacitor until test set indicator reads 5mA; note test set capacitance. The difference in this capacitance setting and that obtained in operation (3) (f) should be (depending on type of cable fitted) as follows :-

| | | |
|---|---|---|
| Cable MCK32 | ... | 243 ± 11 pF. |
| Cable MCK.A.32 | ... | 247 ± 11 pF. |

(c) Connect cable MCK32 or MCK.A.32 to tank unit 72TN.

(12) (a) Switch OFF test set, de-energize the aircraft d.c. busbars (see Chapter 24, GENERAL) and disconnect cables CGA110, CGA111 and CG114 from aircraft cable socket and amplifier plug.

(b) Disconnect cable CE1 AND THE CGA109 adapter, from the MCK30 or MCK.A.30 or MCK B.30 (Mod.252858) cable socket and the 74TN tank unit plug.

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(c) Connect and secure cable MCK30 or MCK.A.30 or MCK B.30 (Mod.252858) socket to the 74TN tank unit plug.

(d) Fit tank manhole covers and access panels as necessary (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(e) Trim fuel contents indicator see para.1.D.

D.Trim fuel contents indicators

Equipment required :-

Aircraft jacks and trestles ) see Chapters 7 and 8
Levelling bars and clinometer )
Hydrometer and thermometer
Fuel drain adapters BAe.25-Y-867A or 25-Y-635A (supplied as part of BAe.TS-61R-243A)

A rig or refueller of known accuracy capable of :-

(a) Measuring the quantity of fuel into a tank via the overwing filler.

(b) Measuring the quantity of fuel taken from a tank via the fuel drain adapter.

Open containers for draining fuel tanks
Ground supply power
Watch
Measure (Imp. galls., U.S. galls or litres.)
Ruler.

(1) Position aircraft on level ground.

(2) Defuel aircraft until approximately 100 lb (45.36 kg) of fuel remains in each tank.

(3) Jack, trestle and level aircraft with all datums level (see Chapter 7, LIFTING AND SHORING and Chapter 8, LEVELLING AND WEIGHING).

(4) In the flight compartment ensure that the crossfeed, transfer and engine low pressure fuel shut-off valves are closed.

(5) Position the open fuel containers beneath the fuel drain valves and bond containers to aircraft.

(6) Connect the fuel drain adapters to the fuel drain valves, open adapters and drain tanks to fuel drain level. When draining is

...Fuel contents indicating (capacitance system) - Maintenance practices continued

complete close fuel drain adapters, and remove open containers (see Chapter 12, SERVICING - FUEL).

(7) Connect the ground power supply to the aircraft and energize the fuel contents indicating system circuits (see Chapter 24, GENERAL). Record busbar voltage; this must be between 27.5 and 28 volts d.c. Allow 10 minutes for the contents indicating system to warm up.

(8) Measure and record the temperature and specific gravity of the fuel to be used. Calculate, at the specific gravity obtained, the amount of fuel in Imp. galls., U.S. galls. or Litres to obtain 100 lb (45.36 kg) of fuel, using the appropriate formula given, where s.g. = specific gravity :-

(a) 100 lb. to Imp. galls. = $\frac{100}{10 \times \text{s.g.}}$

(b) 100 lb. to U.S. galls. = $\frac{100}{8.327 \times \text{s.g.}}$

(c) 45.36 kg. to Litres = $\frac{45.36}{\text{s.g.}}$

(9) Using the rig or refueller (of known accuracy), fully prime hoses and refuel each tank with the amount of fuel calculated (the equivalent of 100 lb (45.36 kg)) via the overwing filler. Close filler cap.

(10) Check that the fuel booster pump switches are OFF and after 20 minutes read fuel contents indicators in the flight compartment; both tanks should read 100 lb (45.36 kg.).

(11) CAUTION : EXERCISE CAUTION WHEN ENGAGING SCREWDRIVER WITH TRIMMER.

If necessary, adjust system by removing the trimmer cover from the appropriatre cable box, and using a small screwdriver carefully adjust trimmer until indicator reads 100 lb (45.36 kg). Fit trimmer cover.

NOTE : If the fuel contents indicating system calibration test is to be carried out, ignore operations (12) to (14) and proceed with operation (2) of para. 1.E.

(12) Switch OFF fuel contents indicating system and the aircraft electrical ground supply.

(13) Disconnect and remove the fuel drain adapters.

(14) Remove trestles, lower aircraft to ground and remove jacks.

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...Fuel contents indicating (capacitance system) - Maintenance practices continued

E. Test fuel contents indicating system calibration

Equipment required :- as for para. 1.D.

CAUTION : ENSURE THAT THE AIRCRAFT JACKING WEIGHT IS NOT EXCEEDED DURING THE FOLLOWING OPERATIONS

(1) Trim fuel contents indicators (see para. 1.D.).

NOTE : The aircraft booster pumps must be ON for operations (2) to (7) of this test.

(2) Fully prime all rig or refueller hoses, and with meters set to zero, fill tanks via the overwing filler until fuel is 1.5 in. below the wing skin at the filler neck. Close filler caps.

NOTE : Fill both tanks simultaneously, but if only one rig or refueller is available, or only one tank to be calibration checked, half fill the opposite tank before proceeding with operation (2). This is to prevent uneven stresses on the aircraft, whilst on jacks.

(3) Record the quantity of fuel used to fill each tank; this should be, pre Mod.258298, between 506 and 510 Imp. galls. (607.7 and 612.5 U.S. galls. or 2300 and 2318 litres) in each tank, or Mod.258298, between 502 and 506 Imp. galls.

(4) Calculate weight of fuel in each tank, that is, weight of fuel added during operation (2), plus the 100 lb put in during contents indicator zeroing. The s.g. must be the specific gravity of fuel used.

(a) Total weight of fuel in tank (Imp.galls to lb)
= 10 (s.g. x fuel added in Imp.galls) + 100 lb already in tank.

(b) Total weight of fuel in tank (U.S. galls to lb)
= 8.327 (s.g. x fuel added in U.S. galls) + 100 lb already in tank.

(c) Total weight of fuel in tank (Litres to kg.).
= (s.g. x fuel added in litres) + 45.36 kg. already in tank.

(5) Check that contents indicators in the flight compartment read the respective calculated weights ± 150 lb (68 kg.).

(6) Fully prime rig or refueller hoses and connect to fuel drain adapters, open adapters and withdraw fuel from the tanks at a continuous rate of approximately 300 Imp.galls/hr (360 U.S. galls/hr. 1364 litres/hr). At each 20 Imp.galls (24 U.S. galls, 91 litres) withdrawn from each tank, record total quantity removed (from each tank) and the contents indicator readings in the flight compartment.

(7) When only 80 lb (36.2 kg) of fuel remains in each tank stop rig or refueller, close fuel drain adapters, take final rig or refueller readings and disconnect hoses from fuel drain adapters.

(8) Switch OFF fuel booster pumps and contents indicating systems. Remove electrical ground power supply.

(9) Position an empty open fuel container beneath each fuel drain adapter and bond to aircraft. Open fuel drain adapters and drain tanks to fuel drain level. Record quantity of fuel drained from each tank.

(10) Calculate the total amount of fuel taken from each tank, in lb at each 20 Imp.gall. (24 U.S. galls., 91 litres) interval, (using specific gravity of fuel in use). Subtract this figure from tanks full reading taken in operation (5). Compare calculated figure with indicator readings taken at the corresponding time. Use the appropriate formula from the following :-

(a) Imp. galls to lb = 10 (s.g. x total fuel removed in Imp galls).

(b) U.S. galls to lb = 8.327 (s.g. x total fuel removed in U.S. galls).

(c) Litres to kg = (s.g. x total fuel removed in Litres).

(11) Check that the total quantity of fuel removed, equals the total amount put in.

NOTE : The total amount put in, includes the 100 lbs used to trim contents indicators.

(12) Remove fuel containers and disconnect fuel drain adapters.

(13) Remove trestles, lower aircraft to ground and remove jacks.

## 2. Removal/Installation

### A. Tank units 75TN, 76TN, 77TN

(1) Remove tank unit :-

WARNING : DO NOT COMMENCE WORK BEFORE THE TANK HAS BEEN PURGED OF FUEL FUMES. USE EXPLOSION PROOF INSPECTION LAMP.

(a) Purge tank. For method see Chapter 28, TANKS.

(b) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

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(c) Remove access panel (see Chapter 28, MANHOLE COVER AND ACCESS PANELS) on top skin adjacent to the unit to be removed.

(d) Release coaxial cables and fit protective caps over the unit connectors.

(e) Remove bolts securing tank unit to support bracket and, easing base of unit away from bracket, withdraw unit from top supporting ring.

(2) Install tank unit :-

(a) Examine unit visually for signs of damage, corrosion, and other defects.

(b) Ease top of unit into support ring, align fixing holes, and secure unit with bolts, nuts, and washers.

(c) Remove protective caps from unit connectors and secure coaxial cables.

(d) Carry out Tests C, D, and E.

(e) Refit access panel (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

B. Tank units 72TN, 73TN and 74TN

(1) Remove tank unit :-

WARNING : DO NOT COMMENCE WORK BEFORE THE TANK HAS BEEN PURGED OF FUEL FUMES. USE EXPLOSION PROOF INSPECTION LAMP.

(a) Purge tank. For method see Chapter 28, TANKS.

(b) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(c) Remove manhole cover on bottom skin adjacent to the unit to be removed (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(d) Release coaxial cables and fit protective caps over the unit connectors.

(e) Remove bolts securing tank unit to support bracket and, easing the base of unit away from bracket, withdraw bracket from top supporting ring.

...Fuel contents indicating (capacitance system) - Maintenance practices continued

(2) Install tank unit :-

(a) Examine unit visually for signs of damage, corrosion, and other defects.

(b) Ease top of unit into support ring, align fixing holes, and secure unit with bolts, nuts, and washers.

(c) Remove protective caps from unit connectors and secure coaxial cables.

(d) Carry out Test C.

(e) Fit manhole cover (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(f) Carry out Tests D and E.

C. Cable boxes

(1) Remove cable box :-

(a) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(b) Disconnect cables from unit and place protective caps over box connectors.

(c) Remove fixing nuts and remove unit from airframe.

(2) Install cable box :-

(a) Examine cable box visually for signs of corrosion, damage, and other defects.

(b) Secure cable box to airframe.

(c) Remove protective caps from box and connect coaxial cables.

(d) Carry out Test D.

D. Amplifier

(1) Remove amplifier :-

(a) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(b) Disconnect cables from amplifier and place protective caps over amplifier connectors.

...Fuel contents indicating (capacitance system) - Maintenance practices continued

(c) Release the fastener securing anti-vibration mounting to fixing bracket; remove amplifier and mounting.

(2) Install amplifier :-

(a) Examine amplifier visually for signs of damage, corrosion and other defects.

(b) Engage flange on mounting with the lip on the fixing bracket. Position amplifier and mounting on the bracket and secure with fastener.

(c) Remove protective caps from amplifier connectors.

(d) Connect and secure connector sockets to amplifier plugs.

(e) Carry out Tests A and D.

E. Indicator

(1) Remove indicator :-

(a) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(b) Slacken indicator pan-head clamp adjusting screw and ease indicator forward.

(c) Disconnect electrical cables from indicator.

(2) Install indicator :-

(a) Examine indicator for signs of damage.

(b) Connect and secure electrical cables to indicator.

(c) Position indicator in its mounting hole and tighten clamp adjusting screw.

(d) Carry out Tests A and D.

F. Tank terminals

When installing tank terminal MB54 torque tighten special nut to 25 lbf in.

...Fuel contents indicating (capacitance system) - Maintenance practices continued

G.Coaxial cables

(1) Remove coaxial cable :-

WARNING : DO NOT COMMENCE WORK BEFORE THE TANK HAS BEEN PURGED OF FUEL FUMES. USE EXPLOSION PROOF INSPECTION LAMP.

(a) For coaxial cables installed in tank, purge tank. For method see Chapter 28, TANKS.

(b) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(c) For cables installed in tank, remove manhole covers and/or access panel(s) (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS) to gain access to the relevant cable.

(d) Slacken clipping securing cable, and disconnect cable sockets from appropriate components.

(e) Remove cable from aircraft.

(2) Install coaxial cable :-

(a) Examine cable for signs of damage.

(b) Position coaxial cable in its normal run, and secure strapping. Connect and secure cable sockets to the appropriate components.

(c) Carry out Test C.

(d) Fit manhole cover(s) and/or access panels as necessary (see Chapter 28 - MANHOLE COVERS AND ACCESS PANELS).

(e) Carry out Tests D and E.

(3) Sealing of coaxial cable MCK47 (pre Mod.252763) or MCK-A-45 (Mod.252763) or MCK-B-45 (Mod.252858) after installation :-

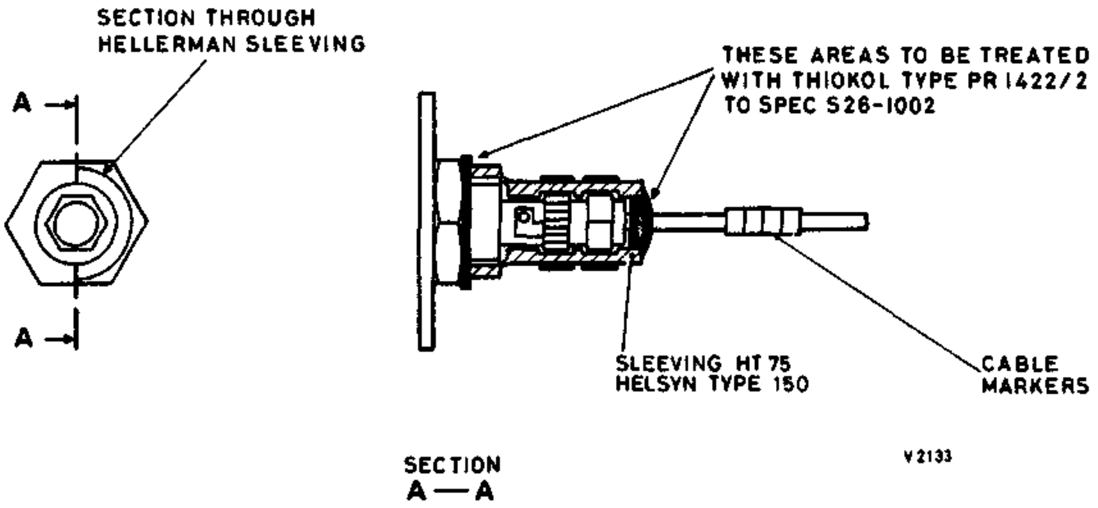
(a) Ensure both mating surfaces of plug assembly are clean and moisture free.

(b) Pull back cable markers to approximate position shown on Fig.202.

(c) Place sleeve over plug assembly as shown, ensuring that sleeve is butted against locknut.

(d) Apply Thiokol to Spec S26-1002 (see Chapter 20) to end surface of sleeve and locknut mating face, finishing with a bead of Thiokol around joint to make good moisture-proof seal.

(e) At other end of sleeve, insert Thiokol between sleeve and cable to make good moisture-proof seal.



Sealing of coaxial cable
Fig.202

* * *

# FUEL CONTENTS INDICATING (CAPACITANCE) SYSTEM (Mod.252572) - DESCRIPTION AND OPERATION

## 1. Description

The Smiths Type 7 fuel contents gauge systems provide a continuous indication of the quantity of fuel in the tanks on two indicators in the flight compartment. Each system measures the capacitance of a set of tank units and their connecting coaxial cables and presents a change of this capacitance as a measure of fuel quantity.

## 2. Operation

The tank units are open-ended concentric capacitors and are so positioned within the fuel tanks that, between certain limits, the value of capacitance measured is independent of aircraft attitude.

As fuel and air have different permittivities, and the tank units are open-ended tubes, changes in fuel level produce proportionate changes in capacitance. Each set of tank units is connected to a cable box which converts the signal from the two terminal tank system into a signal compatible with the three terminal type 7 amplifier. The cable box also alters the empty and full tank range capacitance to the values between which the amplifier operates; zero adjustment of the system is made possible by a trimmer capacitor in each cable box, but there is no provision in situ for adjustment to the FULL capacitance.

The amplifier supplies a selected a.c. drive voltage to the capacitance tank unit system and processes the output current from that system into a form suitable to drive a moving coil indicator. The moving coil indicator current will be 2 and 7 mA corresponding to empty and full tank contents respectively. To achieve this current range the appropriate drive voltage to the tank unit system is selected by means of links on the main connector. Empty and full trimming is provided in order that calibration adjustments can be made during bench check only.

Location of the components in the system is shown on Fig.1, the amplifier and cable boxes being bolted directly to the airframe.

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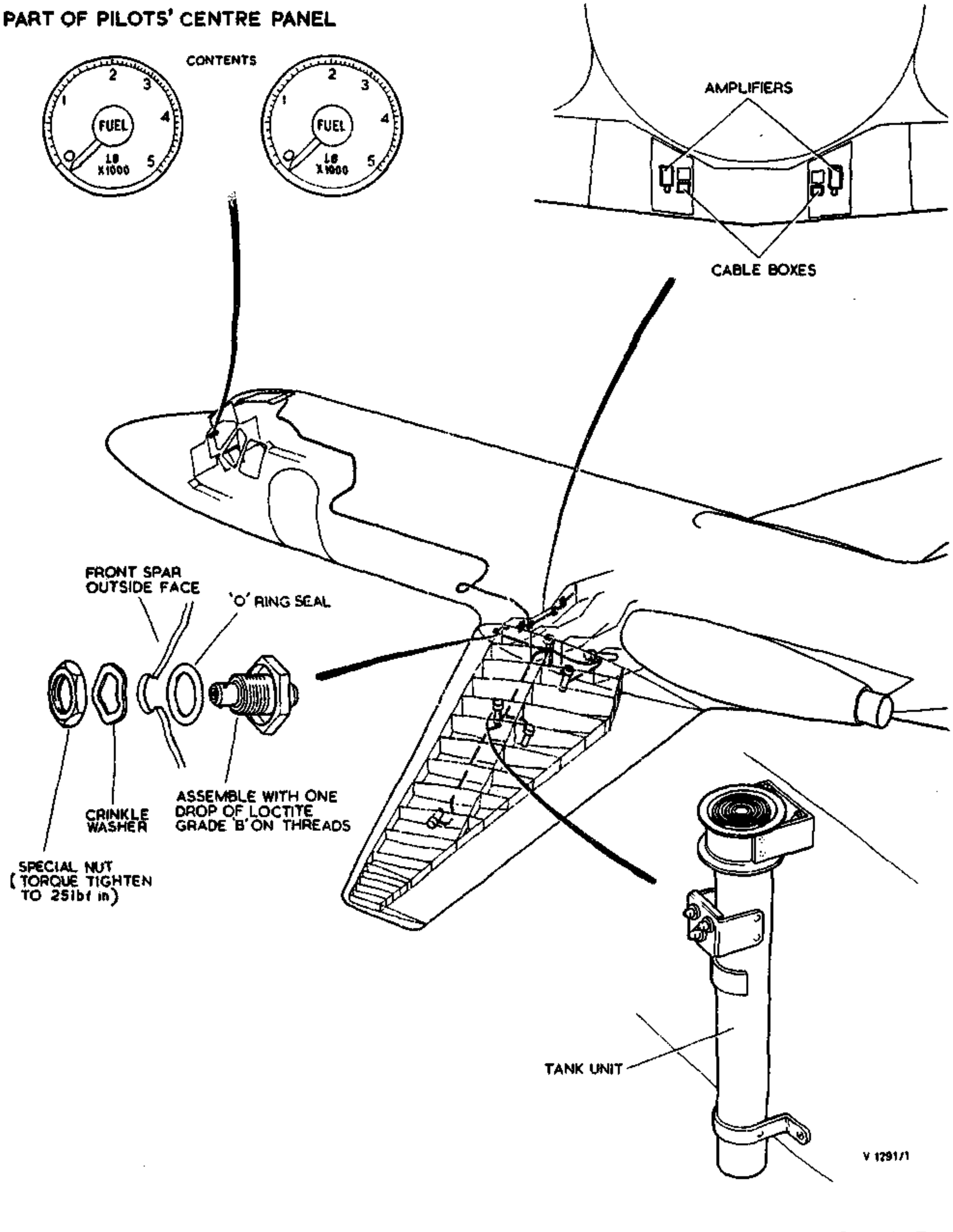
PART OF PILOTS' CENTRE PANEL
CONTENTS
FUEL
LB X1000
0
1
2
3
4
5
AMPLIFIERS
CABLE BOXES
FRONT SPAR OUTSIDE FACE
'O' RING SEAL
ASSEMBLE WITH ONE DROP OF LOCTITE GRADE 'B' ON THREADS
CRINKLE WASHER
SPECIAL NUT (TORQUE TIGHTEN TO 25lbf in)
TANK UNIT
V 1291/1

Layout of fuel contents system
Fig.1

* * *

## FUEL CONTENTS INDICATING (CAPACITANCE) SYSTEM (Mod.252572) - TROUBLE SHOOTING

### 1. General

If a fuel contents system is suspect, the following trouble shooting procedures should be carried out using the Smiths QAA test set with test cables 242BTE and CGA109. The method of connecting the test set into the system, is given in the appropriate test (see Page 201 block).

The trouble shooting procedures are contained on three charts as follows :-

Chart 101 - Indicator, amplifier and cabling

Chart 102 - Cable box

Chart 103 - Tank units and associated co-axial cables

It is unnecessary to drain the fuel tanks when following Chart 101 or Chart 102, but before attempting the tests on Chart 103, the aircraft must be rigged level, the fuel tanks drained to water drain valve level, opened and purged of fuel fumes (see Chapter 12, SERVICING-FUEL and Chapter 28, TANKS).

Where reference is made to Tests A (1), B (1), C (1) etc. these tests refer to the paragraphs and operations of Adjustment/Test (see Page 201 block).

The sequence of disconnection given is to start at the most extreme outboard unit and gradually work inboard until the faulty component is found, Table 202 supports this sequence. This does not preclude any other sequence being adopted. The wing system can be sub-divided, by reference to Fig.101, at suitable access points and using component capacitance values given in Table 202.

When a component has been isolated using these trouble shooting procedures, it should be removed in accordance with the Removal/Installation procedures and then be subjected to the tests laid down in the relevant OVERHAUL MANUAL, before discarding as unserviceable. Particular attention must be paid when installing a component to ensure that the relevant tests, called for in the installation operations, are carried out.

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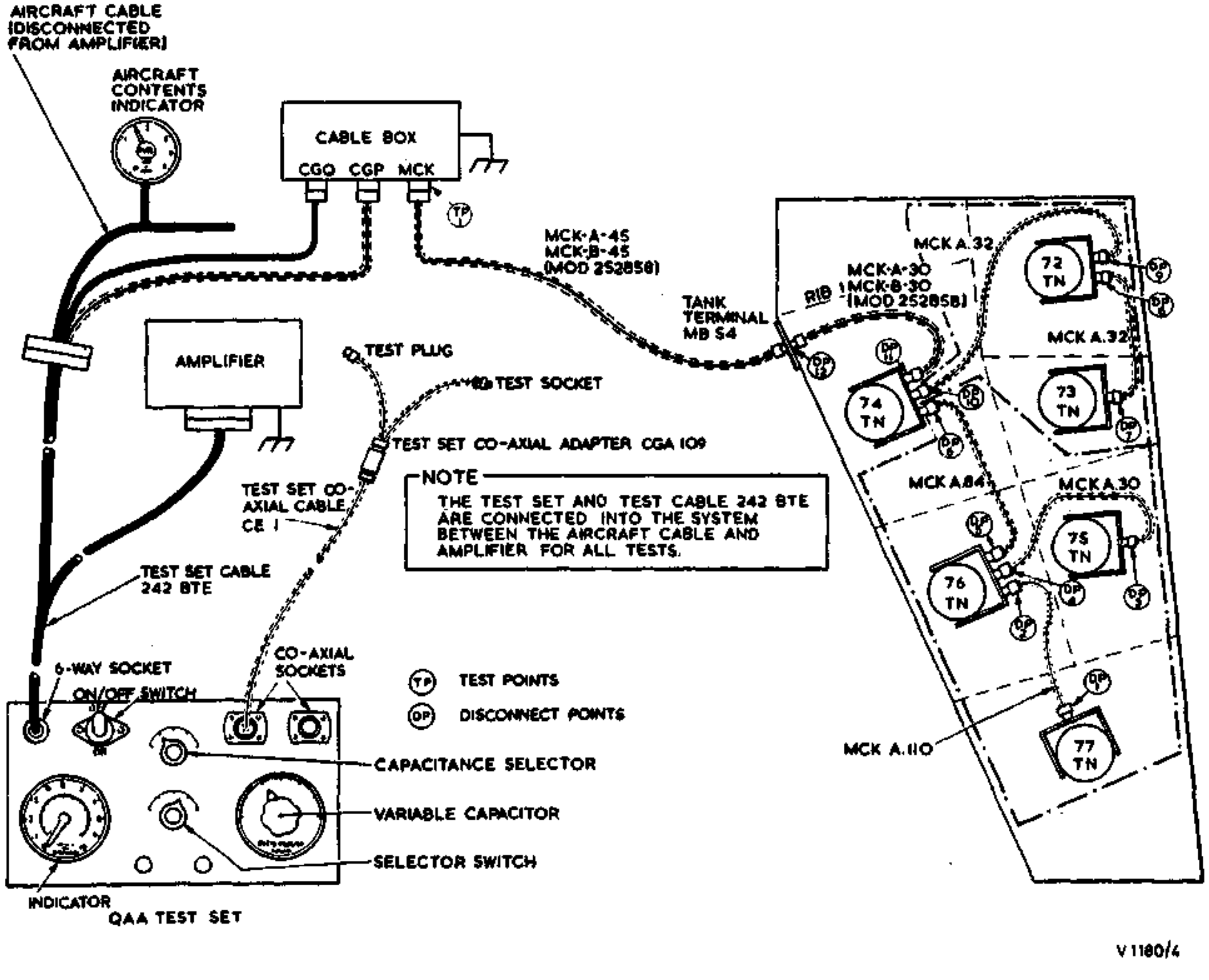
...Fuel contents indicating (capacitance) system (Mod.252572) - Trouble shooting continued



NOTE

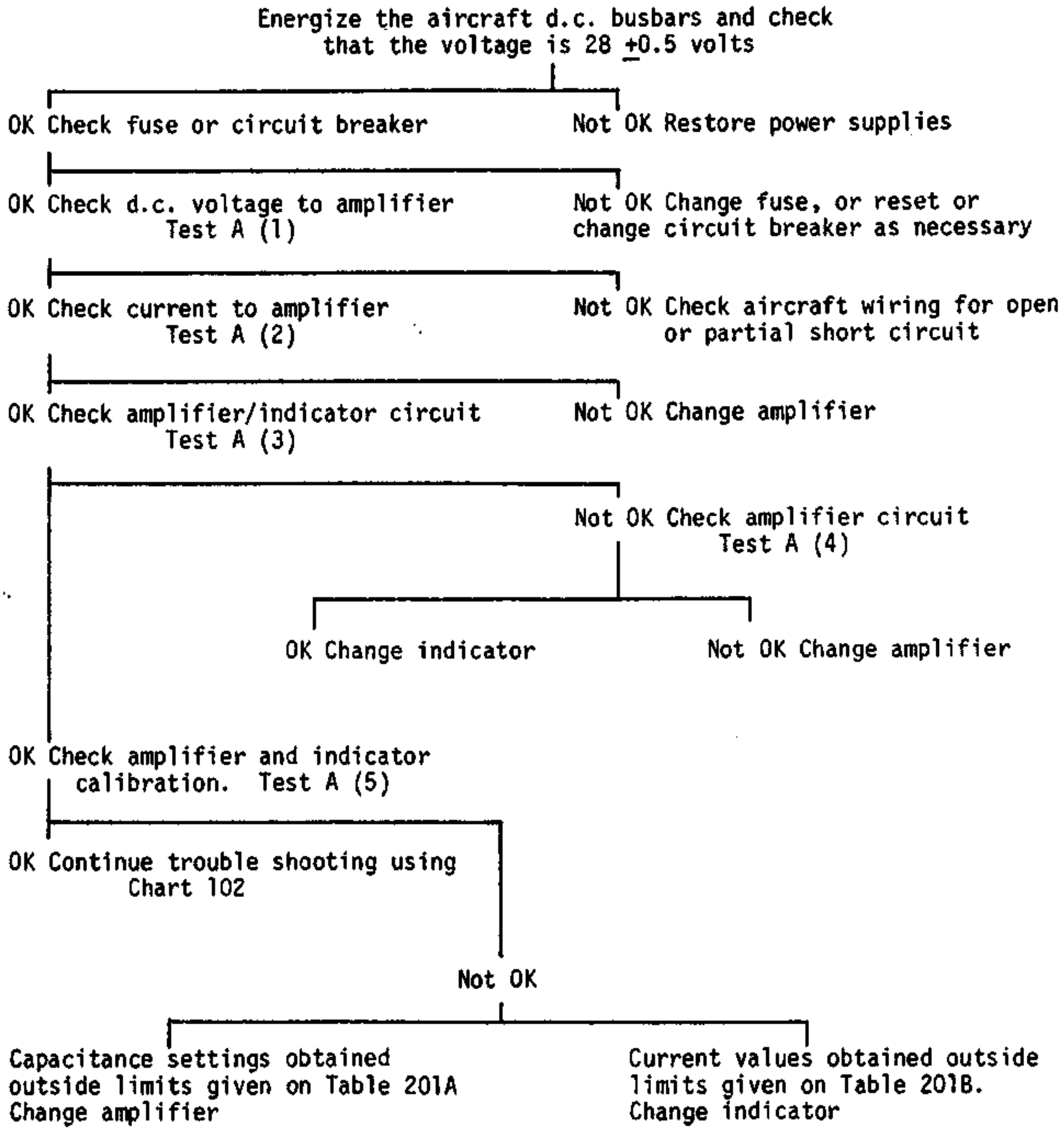
THE TEST SET AND TEST CABLE 242 BTE ARE CONNECTED INTO THE SYSTEM BETWEEN THE AIRCRAFT CABLE AND AMPLIFIER FOR ALL TESTS.

Test and disconnection points
Fig.101

...Fuel contents indicating (capacitance) system (Mod.252572) - Trouble shooting continued

## Chart 101

## INACCURATE OR ZERO READING ON CONTENTS INDICATOR


Energize the aircraft d.c. busbars and check that the voltage is 28 ±0.5 volts
OK Check fuse or circuit breaker
Not OK Restore power supplies
OK Check d.c. voltage to amplifier Test A (1)
Not OK Change fuse, or reset or change circuit breaker as necessary
OK Check current to amplifier Test A (2)
Not OK Check aircraft wiring for open or partial short circuit
OK Check amplifier/indicator circuit Test A (3)
Not OK Change amplifier
Not OK Check amplifier circuit Test A (4)
OK Change indicator
Not OK Change amplifier
OK Check amplifier and indicator calibration. Test A (5)
OK Continue trouble shooting using Chart 102
Not OK
Capacitance settings obtained outside limits given on Table 201A Change amplifier
Current values obtained outside limits given on Table 201B. Change indicator

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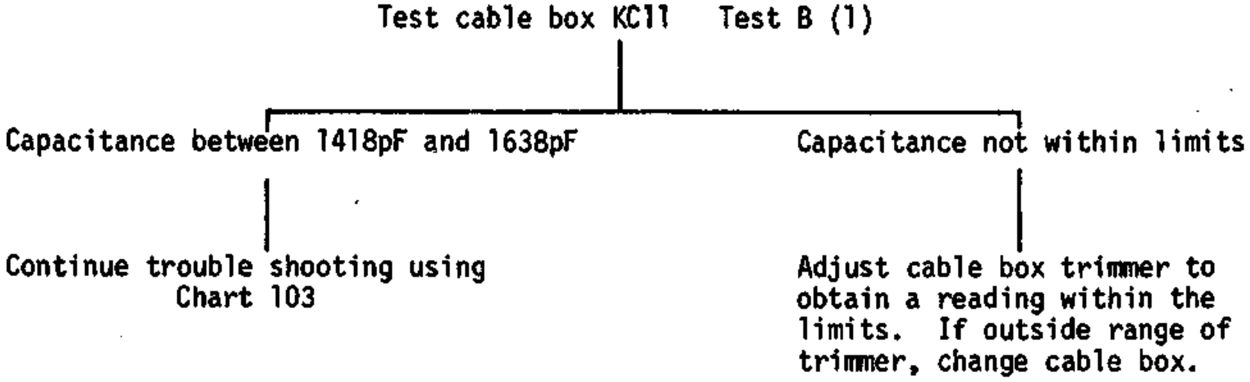
...Fuel contents indicating (capacitance) system (Mod.252572) - Trouble shooting continued

## Chart 102

## INACCURATE OR ZERO READING ON CONTENTS INDICATOR (Continued)



Test cable box KC11 Test B (1)

Capacitance between 1418pF and 1638pF

Continue trouble shooting using Chart 103

Capacitance not within limits

Adjust cable box trimmer to obtain a reading within the limits. If outside range of trimmer, change cable box.

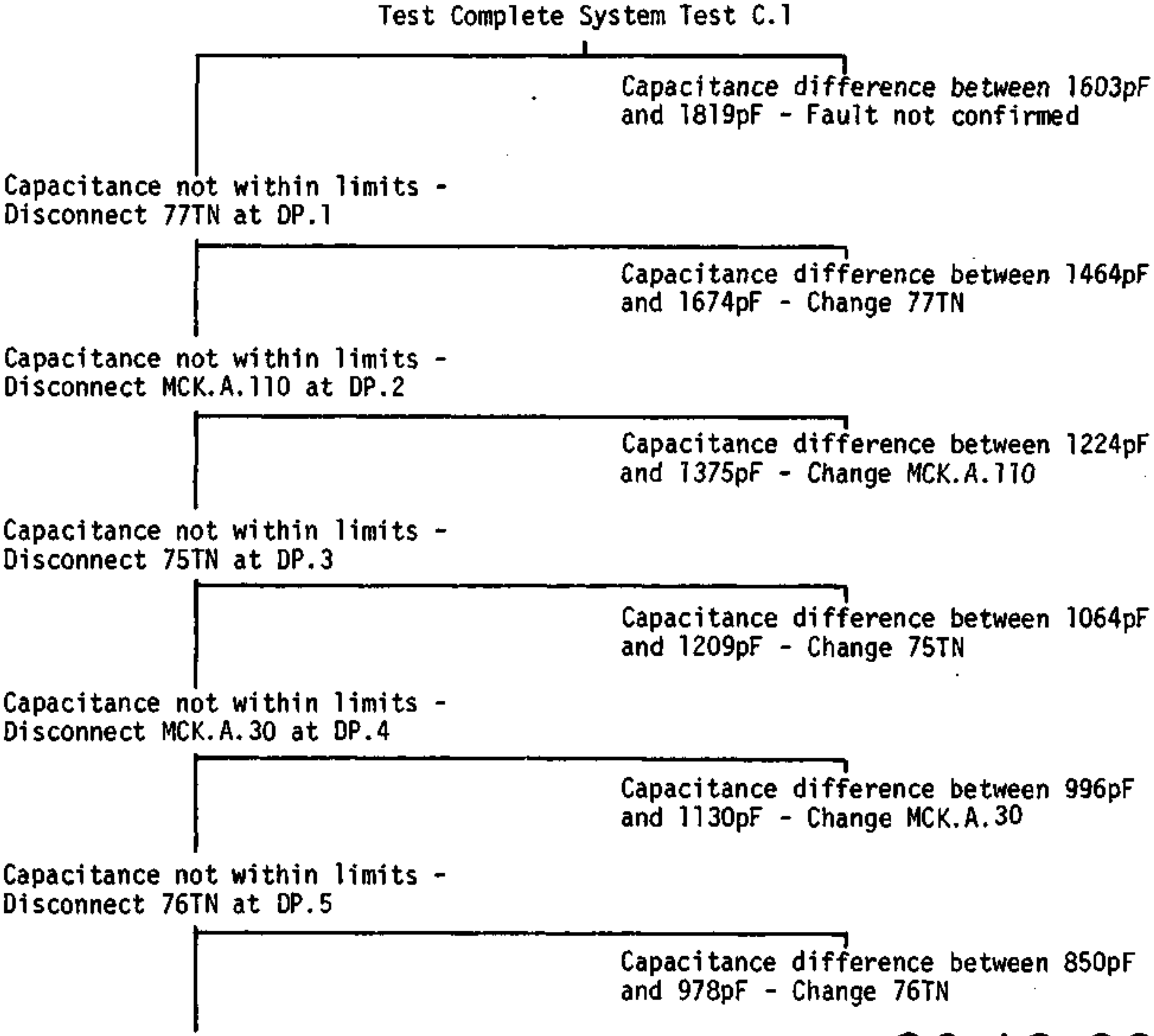
...Fuel contents indicating (capacitance) system (Mod.252572) - Trouble shooting continued

## Chart 103

## INACCURATE OR ZERO READING ON CONTENTS INDICATOR (Continued)

NOTES : 1. Before proceeding with this test, defuel the tanks, rig the aircraft level, drain tanks to water drain valve level, open tanks and purge of fuel fumes (see Chapter 12, SERVICING - FUEL and Chapter 28, TANKS).

2. If the fuel indicator reading is reported as fluctuating erratically during certain flight conditions, but is not present on ground investigation utilizing fault finding Chart 103, check that the MB54 bulkhead adapter is secure.



Test Complete System Test C.1

Capacitance difference between 1603pF and 1819pF - Fault not confirmed

Capacitance not within limits - Disconnect 77TN at DP.1

Capacitance difference between 1464pF and 1674pF - Change 77TN

Capacitance not within limits - Disconnect MCK.A.110 at DP.2

Capacitance difference between 1224pF and 1375pF - Change MCK.A.110

Capacitance not within limits - Disconnect 75TN at DP.3

Capacitance difference between 1064pF and 1209pF - Change 75TN

Capacitance not within limits - Disconnect MCK.A.30 at DP.4

Capacitance difference between 996pF and 1130pF - Change MCK.A.30

Capacitance not within limits - Disconnect 76TN at DP.5

Capacitance difference between 850pF and 978pF - Change 76TN

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...Fuel contents indicating (capacitance) system (Mod.252572) - Trouble shooting continued

## Chart 103
## ACCURATE OR ZERO READING ON CONTENTS INDICATOR (Continued)

Capacitance not within limits -
Disconnect MCK.A.84 at DP.6

Capacitance difference between 667pF and 751pF - Change MCK.A.84

Capacitance not within limits -
Disconnect 73TN at DP.7

Capacitance difference between 602pF and 684pF - Change 73TN

Capacitance not within limits -
Disconnect MCK.A.32 at DP.8

Capacitance difference between 532pF and 596pF - Change MCK.A.32

Capacitance not within limits -
Disconnect 72TN at DP.9

Capacitance difference between 432pF and 492pF - Change 72TN

Capacitance not within limits -
Disconnect MCK.A.32 at DP.10

Capacitance difference between 362pF and 404pF - Change MCK.A.32

Capacitance not within limits -
Disconnect 74TN at DP.11

Capacitance difference between 166pF and 202pF - Change 74TN

Capacitance not within limits -
Disconnect MCK.A.30 or MCK.B.30
(Mod.252858) at DP.12

Capacitance difference between 99pF and 123pF - Change MCK.A.30 or MCK.B.30

Capacitance not within limits -
Change MCK.-A-45 or MCK.-B-45
(Mod.252858)

* * *

# FUEL CONTENTS INDICATING (CAPACITANCE) SYSTEM (Mod.252572) - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove tank units 75TN, 76TN and 77TN

**WARNING** : DO NOT COMMENCE WORK BEFORE THE TANK HAS BEEN PURGED OF FUEL FUMES. USE EXPLOSION PROOF INSPECTION LAMP.

(1) Purge tank (see Chapter 28, TANKS).

(2) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(3) Remove access panel (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS) on top skin adjacent to the unit to be removed.

(4) Release coaxial cables and fit protective caps over the unit connectors.

(5) Remove bolts securing tank unit to support bracket and, easing base of unit away from bracket, withdraw unit from top supporting ring.

### B. Install tank units 75TN, 76TN and 77TN

(1) Examine unit visually for signs of damage, corrosion, and other defects.

(2) Ease top of unit into support ring, align fixing holes, and secure unit with bolts, nuts and washers.

(3) Remove protective caps from unit connectors and secure coaxial cables.

(4) Restore relevant electrical circuit and carry out Tests C, D and E (para.2).

(5) Refit access panel (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

### C. Remove tank units 72TN, 73TN and 74TN

**WARNING** : DO NOT COMMENCE WORK BEFORE THE TANK HAS BEEN PURGED OF FUEL FUMES USE EXPLOSION PROOF INSPECTION LAMP.

(1) Purge tank (see Chapter 28, TANKS).

(2) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(3) Remove manhole cover on bottom skin adjacent to the unit to be removed (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(4) Release coaxial cables and fit protective caps over the unit connectors.

(5) Remove bolts securing tank unit to support bracket and, easing the base of unit away from bracket, withdraw bracket from top supporting ring.

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D. Install tank units 72TN, 73TN and 74TN

(1) Examine unit visually for signs of damage, corrosion, and other defects.

(2) Ease top of unit into support ring, align fixing holes, and secure unit with bolts, nuts and washers.

(3) Remove protective caps from unit connectors and secure coaxial cables.

(4) Restore relevant electrical circuit and carry out Test C (para.2).

(5) Fit manhole covers (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(6) Carry out Tests D and E (para.2).

E. Remove cable box

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Disconnect cables from cable box and place protective caps over box connectors.

(3) Remove fixing nuts and remove unit from airframe.

F. Install cable box

(1) Examine cable box visually for signs of corrosion, damage, and other defects.

(2) Secure cable box to airframe.

(3) Remove protective caps from box and connect coaxial cables.

(4) Carry out Test D (para.2).

G. Remove amplifier

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Disconnect cable from amplifier and place protective cap over amplifier connector.

(3) Remove fixing nuts and remove unit from airframe.

H. Install amplifier

(1) Examine amplifier visually for signs of damage, corrosion and other defects.

(2) Secure amplifier to mainframe.

...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

(3) Remove protective caps from amplifier connector.

(4) Connect and secure connector socket to amplifier plug.

(5) Carry out Tests A and D (para.2).

J. Remove indicator

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Release roof panel CG captive screws and lower panel on to retaining cords.

(3) Disconnect electrical cables from indicator.

(4) Supporting indicator, release clamp adjusting screw and withdraw indicator.

K. Install indicator

(1) Examine indicator for signs of damage.

(2) Position indicator in panel aperture and tighten clamp adjusting screw.

(3) Connect and secure electrical cables to indicator.

(4) Restore relevant electrical circuit and carry out Tests A and D (para.2).

L. Remove coaxial cables

WARNING : DO NOT COMMENCE WORK BEFORE THE TANK HAS BEEN PURGED OF FUEL FUMES. USE EXPLOSION PROOF INSPECTION LAMP.

(1) For coaxial cables installed in tank, purge tank (see Chapter 28, TANKS).

(2) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(3) For cables installed in tank, remove manhole covers and/or access panel(s) (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS), to gain access to the relevant cable.

(4) Slacken clipping securing cable, and disconnect cable sockets from appropriate components.

(5) Remove cable from aircraft.

M. Install coaxial cable

(1) Examine cable for signs of damage.

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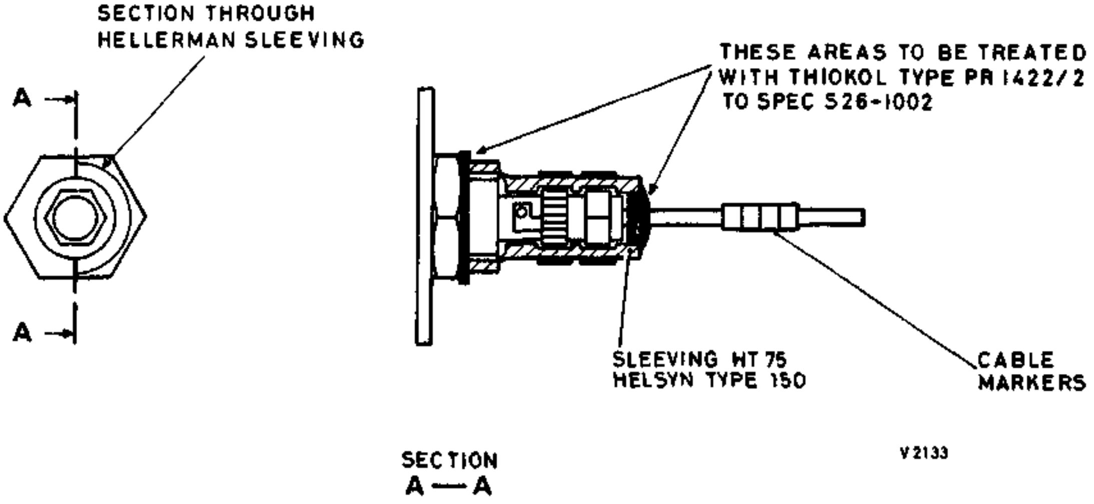
...Fuel contents indicating (capacitance) system (Mod.252575) - Maintenance practices continued

(2) Position coaxial cable in its normal run, and secure strapping. Connect and secure cable sockets to the appropriate components.

(3) If installing coaxial cable MCK.A.45 or MCK.B45 (Mod.252812) to tank terminal MB 54, seal connection as follows :-

(a) Ensure both mating surfaces of plug assembly are clean and moisture free,

(b) Pull back cable markers to approximate position shown on Fig.201.


SECTION THROUGH HELLERMAN SLEEVING
A
A
THESE AREAS TO BE TREATED WITH THIOKOL TYPE PR 1422/2 TO SPEC S26-1002
SLEEVING HT 75 HELSYN TYPE 150
CABLE MARKERS
SECTION A — A
V2133

Sealing of coaxial cable
Fig.201

(c) Place sleeve over plug assembly as shown, ensuring that sleeve is butted against locknut.

(d) Apply Thiokol to Spec S26-1002 (see Chapter 20) to end surface of sleeve and locknut mating face, finishing with a bead of Thiokol around joint to make good moisture-proof seal.

(e) At other end of sleeve, insert Thiokol between sleeve and cable to make good moisture-proof seal.

(4) Restore relevant electrical circuit and carry out Test C (para.2).

...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

(5) Fit manhole cover(s) and/or access panels as necessary (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(6) Carry out Tests D and E (para.2).

## 2. Adjustment/Test

### A. Test amplifier and indicator (Fig.202)

Equipment required :-

Smiths QAA test set, with adapter CGA109 and cables CE1, and 242 BTE.

NOTES : (1) If during the following tests, the readings obtained are not within the tolerances given, refer to the appropriate test reference on Chart 101 of TROUBLE SHOOTING (page 101 block), and rectify as indicated.

(2) If a defect is discovered during a test, switch OFF the test set, and de-energize the aircraft d.c. busbars. Remove the suspect component, and test in accordance with relevant OVERHAUL MANUAL.

(3) On completion of any rectification, repeat the test which located the defective component, and then disconnect the test set cables, reconnect the system cables and test the system as detailed in operation (6).

(1) D.c. supply to amplifier test

(a) Connect the 6-way socket of cable 242BTE to the test set plug.

(b) Disconnect aircraft cable socket from amplifier.

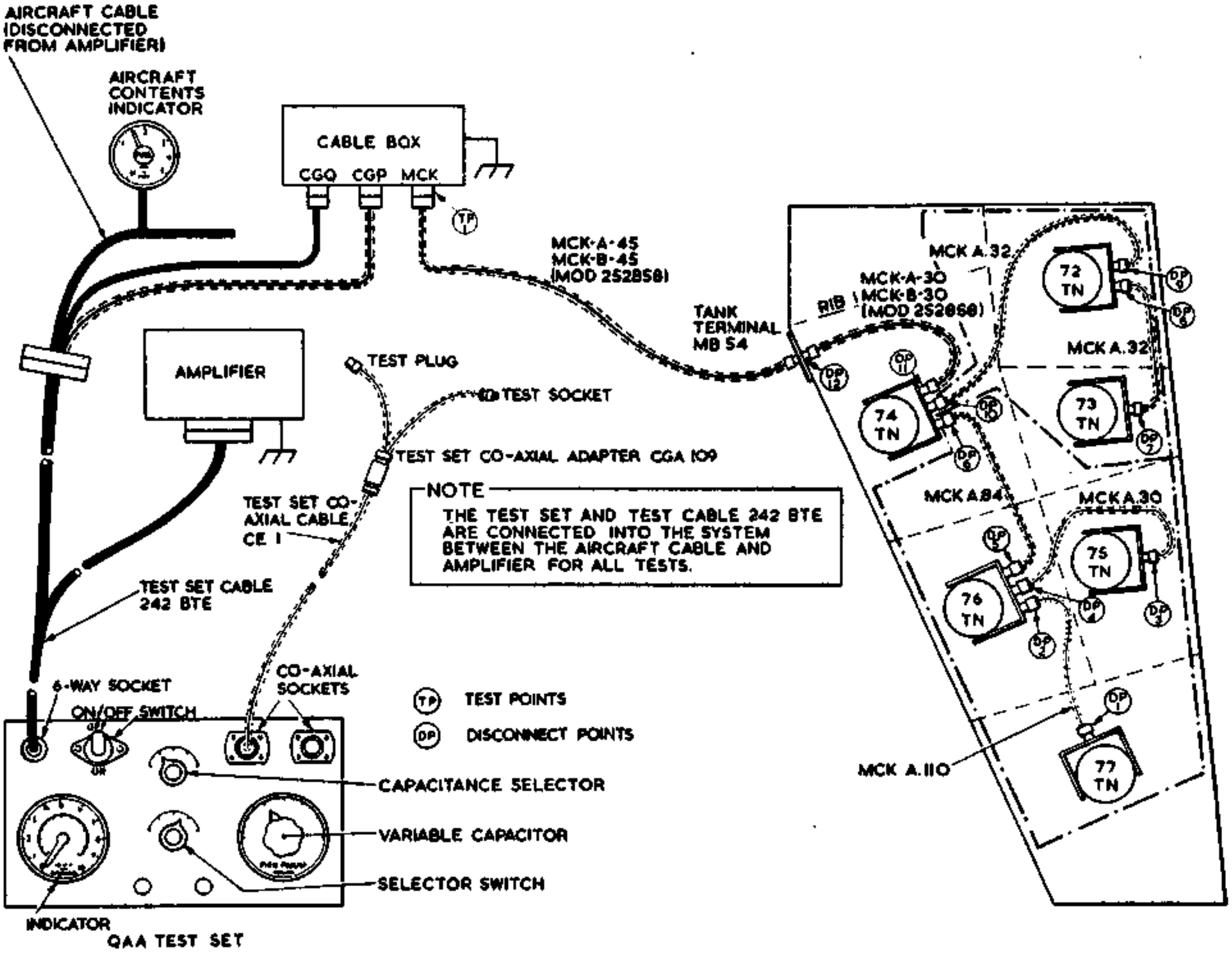
(c) Connect cable 242BTE amplifier.

(d) Connect cable 242BTE to aircraft cable socket.

(e) Energize the aircraft d.c. busbars (see Chapter 24, GENERAL).

(f) Set test set meter ON/OFF switch to ON.

(g) Set test set selector switch to position 1; test set indicator should read 28 ±0.5 volts on the inner scale.



NOTE
THE TEST SET AND TEST CABLE 242 BTE ARE CONNECTED INTO THE SYSTEM BETWEEN THE AIRCRAFT CABLE AND AMPLIFIER FOR ALL TESTS.

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Test and disconnection points
Fig.202

...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

(2) Amplifier current test

Set test set selector switch to position 2; test set indicator should read less than 0.060 amps on the outer scale.

(3) Amplifier and indicator circuit test

Set test set selector switch to position 3; test set indicator should read between 2mA to 7mA on outer scale depending on aircraft fuel state. If the indicator reading is not within these limits, perform the test detailed in para.2.A.(4) to isolate the aircraft indicator. This will point to either faulty aircraft indicator or amplifier.

(4) Amplifier circuit test

Set test set selector switch to position 4; test set indicator should read between 2mA to 7mA on outer scale depending on aircraft fuel state and the aircraft indicator should read below zero (bottom stop).

(5) Amplifier and indicator calibration test

(a) Connect cable CE1 to one of the test set coaxial sockets.

(b) Connect adapter CGA109 to cable CE1.

(c) Disconnect cable MCK-A-45 (or MCK.B.45 if Mod.252858 embodied) from cable box, and connect CGA109 adapter branch socket to the MCK plug of cable box KC.11 (TP1). Leave plug branch of adapter CGA109 disconnected.

(d) Set test set selector switch to position 3.

(e) Set test set capacitance selector and variable capacitor progressively to obtain, on the test set indicator, the current values given in Table 201, A; check at each stage, that the total test set capacitance is within the tolerance given.

NOTE : Capacitance values of CE1 is 150pF and CGA109 is 40pF.

(f) Set test set capacitance selector and variable selector progressively to give, on the test set indicator, the readings shown on Table 201, B; check at each stage, that aircraft contents indicator agrees with figures given.

Table 201 on next page

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...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

Table 201

| A | | B | |
|---|---|---|---|
| Test set indicator reading mA | Test set capacitance pF | Test set indicator reading mA | Aircraft indicator reading lb x 1000 |
| 2.0 | 1528 ±110 | 2.00 ±0.1 | 0 |
| 5.0 | 2185 ±110 | 2.57 ±0.1 | 0.5 |
| 7.0 | 2624 ±110 | 3.02 ±0.1 | 1.0 |
| | | 3.98 ±0.1 | 2.0 |
| | | 4.87 ±0.1 | 3.0 |
| | | 5.90 ±0.1 | 4.0 |
| | | 7.00 ±0.1 | 5.0 |

*The zero mark on type 19AG indicator is at the lower end of the yellow block.

NOTE : If the tests detailed in para.2.B. are to be carried out, ignore para.2.A.(6).

(6) (a) Set the test set meter ON/OFF switch to OFF, de-energize the aircraft d.c. busbars and disconnect the test set cables.

(b) Reconnect the system cables to the amplifier and the cable box.

(c) Trim fuel contents indicator (see para.2.D.).

B. Test cable box

Equipment required :-

Smiths QAA test set, with adapter CGA109 and cables CE.1 and 242 BTE.

(1) Test procedure

NOTE : If the procedures detailed in para.2.A.(1) to (5) have been carried out, but those in para.2.A.(6) have been ignored, ignore para.2.B.(1) (a) to (e).

(a) Connect the test set QAA into the system as detailed on para.2.A.(1) (a) to (e).

(b) Disconnect the cable MCK-A-45 (or MCK.B.45 if Mod.252858 embodied) from the MCK plug of the cable box KC.11.

...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

(c) Connect the cable CE1 to one of the coaxial sockets on the test set and connect the adapter CGA.109 to the cable CE.1. Connect the socket adapter of CGA.109 to the MCK plug on the cable box.

(d) Set the test set selector switch to position 3.

(e) Set the test set meter ON/OFF switch to ON.

(f) Vary the test set capacitance selector and variable capacitor until the test set indicator reads 2mA on the outer scale. Check that the test set capacitance is between 1418pF and 1638pF. Adjustment of E Trimmer on cable box is permitted to obtain capacitance between these limits.

(g) If a defect is found during the test procedure, set the test set meter ON/OFF switch to OFF and de-energize the aircraft d.c. busbars. Remove the suspect cable box and test in accordance with the relevant OVERHAUL MANUAL.

(h) On completion of rectification, repeat the test procedure and when the condition of sub-para.(f) are met, carry out the procedures detailed in para.2.B.(2).

NOTE : If the tests detailed in para.2.C. are to be carried out, ignore para.2.B.(2).

(2) (a) Set the test set meter ON/OFF switch to OFF, de-energize the aircraft d.c. busbars and disconnect the test set cables.

(b) Re-connect the system cables to the amplifier and the cable box.

(c) Trim fuel contents indicator (see para.2.D.).

C. Test system, tank units and cables (Fig.201)

Equipment required :-

Smiths QAA test set, with adapter CGA109 and cables CE.1 and 242 BTE.

NOTE : Before proceeding with this test, rig the aircraft level (see Chapter 8, LEVELLING AND WEIGHING), drain the tanks to water drain level (see Chapter 12, SERVICING - FUEL) and purge the tanks of fuel fumes (see Chapter 28, TANKS).

(1) Test procedure

NOTE : If the procedures detailed in para.2.B.(1) have been carried out, but those detailed in para.2.B.(2) have been ignored, ignore para.2.C.(1) (a) to (e).

(a) Connect the test set QAA into the system as detailed in para.2.A.(1) (a) to (e).

(b) Disconnect the cable MCK-A-45 (or MCK.B.45 if Mod.252858 embodied) from the MCK plug on the cable box KC.11.

(c) Connect the cable CE1 to one of the coaxial sockets on the test set and connect the adapter CGA.109 to the cable CE.1. Connect the socket adapter of CGA.109 to the MCK plug on the cable box.

(d) Set the test set selector switch to position 3.

(e) Set the test set meter ON/OFF switch to ON.

(f) Vary the test set capacitance selector and variable capacitor until the test set indicator reads 5mA on the outer scale. Note the total capacitance (i.e. the capacitance selector value + the variable capacitor value).

(g) Set the test set meter ON/OFF switch to OFF and reduce the test set capacitance to a minimum.

(h) Connect the plug adapter of CGA.109 to the socket on the free end of the cable MCK-A-45 (or MCK.B.45 if Mod.252858 embodied).

(j) Set the test set meter ON/OFF switch to ON.

(k) Vary the test set capacitance selector and variable capacitor until the test set indicator reads 5mA on the outer scale. Note the total capacitance (i.e. the capacitance selector value + the variable capacitor value).

(l) Check that the difference between the capacitance value noted at sub.para. (f) and the capacitance value noted at sub.para.(k) is between 1603.26pF and 1819.22pF as shown on Table 201.

(m) Set the test set meter ON/OFF switch to OFF.

(n) Isolate the tank units and cables by disconnecting the cables at DP1 to DP12, in numerical sequence, and repeat the procedure detailed in sub.para.(e) to (m), at each DP until the faulty unit is isolated, comparing the capacitance difference with the limits given at the respective DP on Table 202.

(p) If a defect is found during the test procedure, set the test set meter ON/OFF switch to OFF and de-energize the aircraft d.c. busbars. Remove the suspect component and test in accordance with the relevant OVERHAUL MANUAL.

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...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

(q) On completion of any rectification, repeat the test procedure and when the conditions of sub.para.2.(1) are met, carry out the procedures detailed in para.2.C.(2).

Table 202

System capacitance

| Capacitance (pF) measured at TP1 | | System disconnected at | Item disconnected at | Capacitance (pF) of disconnected component | |
|---|---|---|---|---|---|
| Lower limit | Upper limit | | | Lower limit | Upper limit |
| 1603 | 1819 | - | - | - | - |
| 1464 | 1674 | DP1 | 77TN | 139.00 | 145.00 |
| 1224 | 1375 | DP2 | MCK.A.110 | 240.60 | 299.40 |
| 1064 | 1209 | DP3 | 75TN | 160.00 | 166.00 |
| 996 | 1130 | DP4 | MCK.A.30 | 67.20 | 78.60 |
| 850 | 978 | DP5 | 76TN | 146.00 | 152.00 |
| 667 | 751 | DP6 | MCK.A.84 | 183.70 | 227.20 |
| 602 | 684 | DP7 | 73TN | 65.00 | 67.00 |
| 532 | 596 | DP8 | MCK.A.32 | 70.00 | 88.20 |
| 432 | 492 | DP9 | 72TN | 100.00 | 104.00 |
| 362 | 404 | DP10 | MCK.A.32 | 70.00 | 88.20 |
| 166 | 202 | DP11 | 74TN | 196.00 | 202.00 |
| 99 | 123 | DP12 | *MCK.A.30 | 67.20 | 78.60 |
| 62.65 | 86.65 | DP12 | **MCK.B.45 | 100.80 | 117.90 |

** Aircraft with Mod.252812 only
* MCK.B.30 (Mod.252858)

(2) (a) Set the test set meter ON/OFF switch to OFF, de-energize the aircraft d.c. busbars and disconnect the test set cables.

(b) Reconnect the system cables to the amplifier and the cable box.

(c) Fit tank manhole covers and access panels as necessary (see Chapter 28, MANHOLE COVERS AND ACCESS PANELS).

(d) Trim full contents indicator (see para.2.D.).

...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

### D.Trim fuel contents indicators

Equipment required :-

Aircraft jacks and trestles
Levelling bars and clinometer
Hydrometer and thermometer
Fuel drain adapters 25Y635A

A rig or refueller of known accuracy capable of :-
(a) Measuring the quantity of fuel into a tank via the overwing filler.
(b) Measuring the quantity of fuel taken from a tank via the fuel drain adapter.
Open containers for draining fuel tanks
Ground power supply
Watch
Measure (Imperial gallons, U.S. gallons)
Ruler

(1) Position aircraft on level ground.

(2) Defuel aircraft unit until approximately 100 lb of fuel remains in each tank.

(3) Jack, trestle and level aircraft with all datums level (see Chapter 7, LIFTING AND SHORING and Chapter 8, LEVELLING AND WEIGHING).

(4) In the flight compartment ensure that the crossfeed, transfer and engine low pressure fuel shut-off valves are closed.

(5) Position the open fuel containers beneath the fuel drain valves and bond containers to aircraft.

(6) Connect the fuel drain adapters to the fuel drain valves, open adapters and drain tanks to fuel drain level. When draining is complete close fuel drain adapters, remove open containers.

(7) Connect the ground power supply to the aircraft and energize the fuel contents indicating system circuits (see Chapter 24, GENERAL). Record busbar voltage; this must be between 27.5 and 28 volts d.c. Allow ten minutes for the contents indicating system to warm up.

(8) Measure and record the temperature and specific gravity of the fuel to be used. Calculate, at the specific gravity obtained, the amount of fuel in Imperial gallons or U.S. gallons to obtain 100 lb of fuel, using the appropriate formula given, where s.g. = specific gravity :-

...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

(a) 100 lb to Imperial gallons = $\frac{100}{10 \times s.g.}$

(b) 100 lb to U.S. gallons = $\frac{100}{8.327 \times s.g.}$

(9) Using the rig or refueller (of known accuracy), fully prime hoses and refuel each tank with the amount of fuel calculated (the equivalent of 100 lb) via the overwing filler. Close filler cap.

(10) After 20 minutes read fuel contents indicators in the flight compartment; both tanks should read 100 lb.

(11) CAUTION : EXERCISE CAUTION WHEN ENGAGING SCREWDRIVER WITH TRIMMER.

If necessary, adjust system by removing the trimmer cover from the appropriate cable box, and using a small screwdriver carefully adjust trimmer until indicator reads 100 lb. Fit trimmer cover.

NOTE : If the fuel contents indicating system calibration test is to be carried out, ignore operations (12) to (14) and proceed with operation (2) of para.2.E.

(12) Switch off and disconnect aircraft electrical ground supply.

(13) Disconnect and remove the fuel drain adapters.

(14) Remove trestles, lower aircraft to ground and remove jacks.

## E. Test fuel contents indicating system calibration

Equipment required :- as for para.2.D.

CAUTION : ENSURE THAT THE AIRCRAFT JACKING WEIGHT IS NOT EXCEEDED DURING THE FOLLOWING OPERATIONS.

(1) Trim fuel contents indicators (see para.2.D.).

(2) Fully prime all rig or refueller hoses, and with meters set to zero, fill tanks via the overwing filler until fuel is 1.5 in. below the wing skin at the filler neck. Close filler caps.

NOTE : Fill both tanks simultaneously, but if only one rig or refueller is available, or only one tank to be calibration checked, half fill the opposite tank before proceeding with operation (2). This is to prevent uneven stresses on the aircraft, whilst on jacks.

...Fuel contents indicating (capacitance) system (Mod.252572) - Maintenance practices continued

(3) Record the quantity of fuel used to fill each tank; this should be between 502 and 506 Imperial gallons (602.9 and 607.6 U.S. gallons) in each tank.

(4) Calculate weight of fuel in each tank, that is, weight of fuel added during operation (2), plus the 100 lb put in during contents indicator zeroing. The s.g. must be the specific gravity of fuel used.

Use the appropriate formula from the following :-

(a) Total weight of fuel in tank (Imperial gallons to lb) = 10 (s.g. x fuel added in Imperial gallons) + 100 lb already in tank.

(b) Total weight of fuel in tank (U.S. gallons to lb) = 8.327 (s.g. x fuel added in U.S. gallons) + 100 lb already in tank.

(5) Check that contents indicators in the flight compartment read the respective calculated weights ±150 lb.

(6) Set the fuel booster PUMP switch(es) to ON.

(7) Fully prime rig or refueller hoses and connect to fuel drain adapters, open adapters and withdraw fuel from the tanks at a continuous rate of approximately 300 Imperial gallons/hr (360 U.S. gallons/hr). At each 20 Imperial gallons (24 U.S. gallons) withdrawn from each tank, record total quantity removed (from each tank) and the contents indicator readings in the flight compartment.

(8) When only 80 lb of fuel remains in each tank stop rig or refueller, close fuel drain adapters, take final rig or refueller readings and disconnect hoses from fuel drain adapters.

(9) Select fuel booster PUMP and ground electrical supply switches off, and remove electrical ground power supply.

(10) Position an empty open fuel container beneath each fuel drain adapter and bond to aircraft. Open fuel drain adapters and drain tanks to fuel drain level.

(11) Calculate the total amount of fuel taken from each tank, in lb at each 20 Imperial gallon (24 U.S. gallons) interval (using specific gravity of fuel in use). Subtract this figure from tanks full reading taken in operation (5). Compare calculated figure with indicator readings taken at the corresponding time. Use the appropriate formula from the following :-

(a) Imperial gallons to lb = 10 (s.g. x total fuel removed in Imperial gallons).

(b) U.S. gallons to lb = 8.327 (s.g. x total fuel removed in U.S. gallons).

(12) Check that the total quantity of fuel removed, equals the total amount put in.

NOTE : The total amount put in, includes the 100 lb used to trim contents.

(13) Remove fuel containers and disconnect fuel drain adapters.

(14) Remove trestles, lower aircraft to ground and remove jacks.

* * *

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# FLOAT SWITCHES (LONG RANGE TANK) - MAINTENANCE PRACTICES)

## 1. Removal/Installation

### A. Remove high level float switch

(1) Close long range tank fuel transfer valve and isolate the high level float switch electrical circuit.

(2) Defuel and drain the long range fuel tank (Chapter 12, SERVICING - FUEL).

(3) Gain access through rear equipment bay door, to float switch mounted on the right-hand access panel.

(4) Disconnect the electrical leads from the float switch.

(5) Remove and retain the nut and bolts securing float switch to access panel.

(6) Withdraw float switch from access panel; discard sealing gasket.

### B. Install high level float switch

(1) Examine replacement float switch for signs of external damage, lift float arm and ensure that float drops under its own weight.

(2) Place a new sealing gasket on the float locating stud, on access panel.

(3) Pass float switch carefully through the opening in the access panel, and align the large hole in switch mounting flange with locating stud on access panel. Fit the nut to retain float switch; do not completely tighten nut.

(4) Ensuring that the bonding surfaces are clean, position the bonding tag and P-clip to align with the appropriate holes in mounting flange, align sealing gasket and mounting flange. Fit all bolts.

(5) Tighten nut and bolts evenly.

(6) Connect and secure the float switch electrical leads.

(7) Restore the high level float switch electrical circuit and energize the PE busbar (see Chapter 24, GENERAL).

(8) Refuel long range tank (see Chapter 12, SERVICING - FUEL). Check that float switch operates when tank high level is reached. Check also for leaks from float switch and its mounting.

(9) De-energize the PE busbar (see Chapter 24, GENERAL).

...Float switches (Long range tank) - Maintenance practices continued

C. Remove low level float switch

(1) Close the long range tank fuel transfer valve.

(2) Isolate the long range tank low level float switch electrical circuit.

(3) Defuel and drain the long range fuel tank (see Chapter 12, SERVICING - FUEL).

(4) Fit landing gear locking pins (see Chapter 10, PARKING AND MOORING).

(5) Release hydraulic system pressure (see Chapter 29, MAIN SYSTEM).

(6) Lower the right-hand main landing gear door.

(7) Remove float switch access panel at rear of right-hand wheel well.

(8) Disconnect the low level float switch electrical leads from terminal block.

(9) Remove and retain the nut and bolts securing float switch to tank.

(10) Remove float switch; discard sealing gasket.

D. Install low level float switch

(1) Examine replacement float switch for signs of external damage, lift float arm and ensure that float drops under its own weight.

(2) Place a new sealing gasket on the float switch locating stud, on tank.

(3) Pass float switch carefully through opening in tank and align the large hole in switch mounting flange with locating stud on tank. Fit the nut to retain float switch; do not completely tighten nut.

(4) Ensure that the bonding surfaces are clean and position the bonding tag to align with appropriate hole in mounting flange, align sealing gasket and mounting flange. Fit all bolts.

(5) Tighten nut and bolts evenly.

(6) Connect and secure the float switch electrical leads to the terminal block KLC on long range tank.

(7) Restore the low level float switch electrical circuit and energize the PE busbar (see Chapter 24, GENERAL).

(8) Refuel long range tank (see Chapter 12, SERVICING - FUEL). Check that float switch operates when fuel rises above low level (indicator changes from EMPTY to cross-hatched). Check float switch and mounting for leaks.

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...Float switches (Long range tank) - Maintenance practices continued

(9) Defuel long range tank (see Chapter 12, SERVICING - FUEL). Check that float switch operates when fuel level drops below low level (indicator changes from cross-hatched to EMPTY).

(10) De-energize the PE busbar (see Chapter 24, GENERAL).

(11) Fit float switch access panel at rear of right-hand wheel well.

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# FLOAT SWITCHES (VENT SURGE TANK) REMOVAL/INSTALLATION

## 1. Vent surge tank float switch

### A. Removal

(1) Isolate relevant electrical circuit (Chapter 24, ELECTRICAL POWER - GENERAL).

(2) Drain vent surge tank.

(3) Remove wing access panel between ribs 13 and 14.

(4) Disconnect float switch electrical cables from terminal block mounted on the inboard face of rib 14.

*NOTE: Do not attempt to disconnect cables from float switch.*

(5) Remove the vent surge tank access panel, complete with N.A.C.A, vent between ribs 12 and 13, (VENT SURGE TANK).

(6) At the outboard face of rib 13, remove and retain, the float switch attachment nuts and washers.

(7) At the inboard face of rib 13, support the float switch, remove the float switch attachment bolts complete with bonded seals, retain bolts and discard bonded seals.

(8) Remove float switch from vent surge tank, discard sealing gasket.

### B. Installation

(1) Examine replacement float switch for signs of external damage.

(2) Using a new sealing gasket, pass the float switch cables through the gasket and the hole in rib 13.

(3) Position the float switch and sealing gasket, correctly, on the inboard side of rib 13.

(4) Locate the attachment bolts, with a new bonded seal under head of each bolt.

(5) Make sure that bonding flex attachment panels are clean and position bonding flex onto appropriate bolt outboard of rib 13, install washers and nuts. Tighten nuts evenly.

(6) Connect and secure float switch electrical cables to terminal block on rib 14.

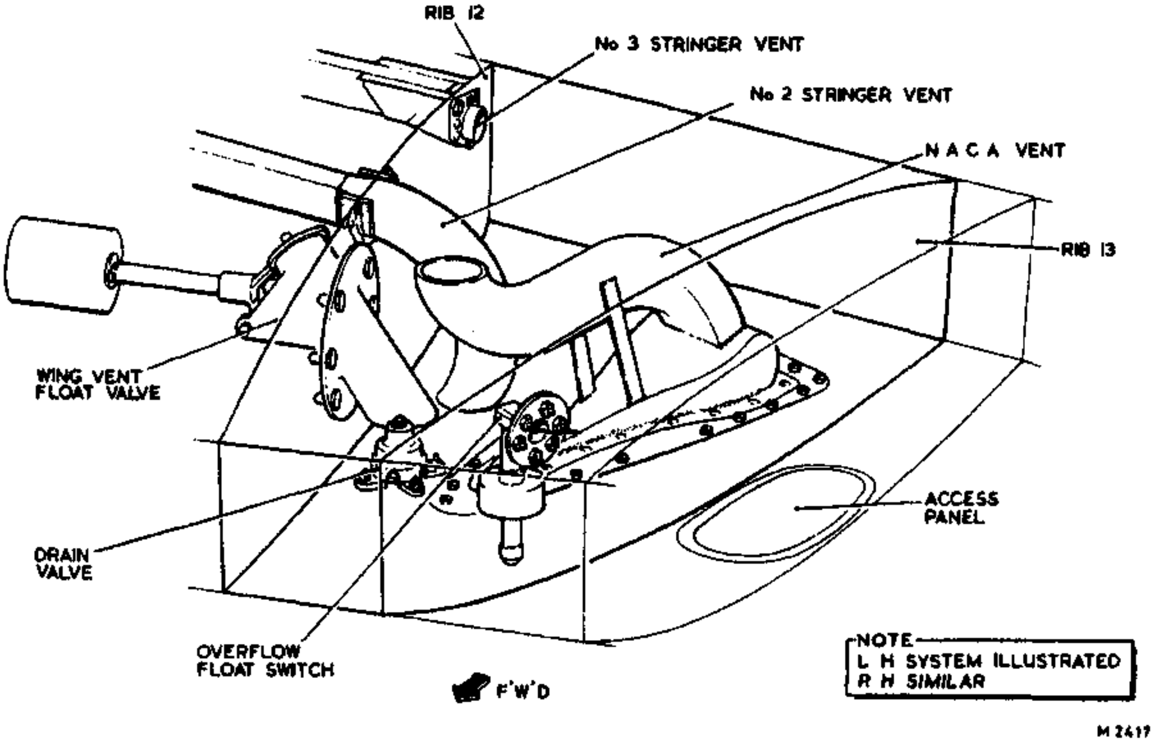
(7) Make sure that there are no loose articles in the tank.

(8) Install vent surge tank access panel complete with N.A.C.A. vent (VENT SURGE TANK).

(9) Refuel wing and ventral fuel tanks (Chapter 12, SERVICING- FUEL).

(10) Restore relevant electrical circuit.

(11) Energize the d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL).



Vent surge tank - components
*Figure 401*

(12) Position an open container below the vent surge tank N.A.C.A. vent outlet and bond to aircraft.

(13) Move AUX FUEL TRANSFER control lever to open down position.

(14) Switch ON the booster pump (on same side as tank under test) and check that related TANK O/FLOW annunciator comes on before fuel vents from the N.A.C.A. vent. Switch booster pump OFF and move the AUX FUEL TRANSFER control lever to the closed (UP) position.

(15) Check vent surge tank access panel and float flange for leaks.

(16) Drain vent surge tank and check that the tank indicator changes from FULL to black.

(17) De-energize the d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL).

(18) Make sure that there are no loose articles in the tank.

(19) Install access panel to lower wing surface between ribs 13 and 14.

# FUEL TEMPERATURE INDICATING SYSTEM - MAINTENANCE PRACTICES

A. Functionally test fuel temperature indicating system

(1) Energize PE busbar (see Chapter 24, GENERAL).

(2) Check that indicator registers approximately ambient temperature.

(3) De-energize PE busbar (see Chapter 24, GENERAL). Check that indicator pointer returns to its off-scale reading.

* * *

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## FUEL TEMPERATURE BULB - MAINTENANCE PRACTICES

### 1. Removal /Installation

#### A. Remove fuel temperature bulb

(1) Isolate fuel temperature bulb electrical circuit (see Chapter 24,GENERAL)

(2) Close left-hand low pressure valve.

(3) Drain left-hand fuel feed pipe.

(4) Disconnect electrical cable from temperature bulb.

(5) Unlock and unscrew union nut. Withdraw temperature bulb.

#### B. Install fuel temperature bulb

(1) Slide union nut over the bulb sheath so that threaded end points towards the end remote from electrical connector; fit locking bush, the collapsed end also pointing away from electrical connector.

(2) Insert bulb into mounting adapter until required degree of penetration is obtained. Tighten union nut until the collapsed portion of locking bush binds firmly into bulb sheath. Wire-lock union nut.

(3) Connect electrical cable to bulb.

(4) Restore fuel temperature bulb electrical circuit.

(5) Bleed engine and fuel feed pipe.

(6) Check for leaks.

(7) Energize d.c. busbars.

(8) Check that indicator shows approximately ambient temperature.

(9) De-energize d.c. busbars.

* * *

# CHAPTER

# 29

# HYDRAULIC POWER

# CHAPTER 29

# HYDRAULIC POWER

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| | 201 | Mar.79(G) |

# HYDRAULIC POWER - GENERAL DESCRIPTION AND OPERATION

## 1. Hydraulic safety precautions

**WARNING:** **BEFORE PRESSURIZING THE HYDRAULIC SYSTEM, MAKE SURE THE CONTROLS MATCH THE COMPONENT POSITIONS.**

**WARNING:** **MAKE SURE THE GROUND LOCKING PINS AND CHOCKS ARE INSTALLED TO THE LANDING GEAR.**

**WARNING:** **MAKE SURE THE TRAVEL RANGE IS CLEAR FOR THE FLYING CONTROL SURFACES.**

**WARNING:** **BE CAREFUL WITH THE HYDRAULIC SYSTEM, IF IT IS PRESSURIZED. RELEASE THE PRESSURE SLOWLY, A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY.**

**WARNING:** **BE CAREFUL WHEN YOU USE THE HYDRAULIC FLUID - WEAR PROTECTIVE CLOTHING AND SAFETY GOGGLES. HYDRAULIC FLUID CAN CAUSE DAMAGE TO THE SKIN AND EYES.**

**WARNING:** **WHEN AN AIRPLANE HAS EXPERIENCED ABNORMAL OR EMERGENCY LANDING GEAR PROCEDURES OF ANY TYPE, INCLUDING AN UNSAFE LANDING GEAR INDICATION OR EMERGENCY EXTENSION OF THE LANDING GEAR, PLACE THE AIRPLANE ON JACKS (AMM 7-10-00) BEFORE PERFORMING ANY INSPECTION OR MAINTENANCE.**

**WARNING:** **MAKE SURE THAT ALL THREE LANDING GEARS ARE DOWN AND LOCKED BEFORE REMOVING THE AIRPLANE FROM JACKS (AMM 7-10-00).**

**CAUTION:** **WHEN FILLING A HYDRAULIC SYSTEM, MAKE SURE THE HYDRAULIC FLUID IS THE SAME TYPE AS THE HYDRAULIC FLUID IN THE AIRPLANE . INCORRECT HYDRAULIC FLUIDS CAN CAUSE DAMAGE TO SYSTEM COMPONENTS AND AFFECT SYSTEM OPERATION WITH POSSIBLE ADVERSE RESULTS.**

**CAUTION:** **HYDRAULIC FLUID DRAINED OR BLED FROM AIRPLANE SYSTEMS IS TO BE DISCARDED. USE ONLY NEW HYDRAULIC FLUID WHEN REPLENISHING AIRPLANE OR GROUND SERVICING RIGS.**

**CAUTION:** **RESIDUES OF CHLORINATED SOLVENTS, IF MIXED WITH WATER, FORM HYDROCHLORIC ACID AND CAUSE CORROSION. TRICHLOROETHYLENE AND OTHER CHLORINATED SOLVENTS MUST NOT BE USED TO CLEAN ANY PART OF A HYDRAULIC OR OTHER PIPED SYSTEM.**

## 2. General

This chapter covers the generation and distribution of hydraulic power. For details of systems supplied, refer to Chapter 27, FLIGHT CONTROLS and Chapter 32, LANDING GEAR.

Hydraulic power is provided by independent main and auxiliary systems.

The main hydraulic system provides power for operation of the flaps, airbrakes, landing gear, wheelbrakes and nosewheel steering, and uses two pumps, driven one by each engine. A handpump, connected into the system, provides power for ground testing of hydraulic services when the engines are not running.

The auxiliary hydraulic system, used only for emergency lowering of the landing gear and flaps, is operated by a further handpump which supplies fluid from an independent supply direct to the landing gear and flap jacks.

## 3. Indication

The following indications are provided in the flight compartment:

- Main system and brakes pressure (refer to Chapter 32, WHEELS AND BRAKES).
- Main system low pressure (HYD LO PRESS annunciators).
- Main system high temperature (HYD SYS OHEAT annunciator).
- Auxiliary tank low level 'not full' warning (AUX HYD LO LEVEL annunciator).
- Emergency brakes accumulator low pressure (EMERG BRK LO PRESS annunciator).
- Emergency brakes operation (refer to Chapter 32, WHEELS AND BRAKES).

The following indication is provided adjacent to the reservoir:

- Reservoir air pressure (HYD TANK LP indicator).

## 4. Pipelines and couplings

High pressure rigid pipelines are fabricated from stainless steel. Suction and return pipelines are fabricated from either stainless steel or aluminium alloy.

Connections to certain components are made using suitable flexible hoses.

The majority of connections are made using flared pipe ends and standard British AGS (AIRCRAFT GENERAL STANDARDS) cone end couplings, collars and nuts. The remaining connections are made using standard American AN (AIR FORCE - NAVY AERONAUTICAL STANDARD) or (MILITIARY STANDARD) fittings, as required by various vendor components.

# GENERAL - ADAPTER/COMPONENT MAINTENANCE PRACTICES

## 1. Removal/Installation

Adapters and elbows with straight threads are orientated to suit the lay of the pipe/hose in the particular installation. To effect this requirement and yet achieve a leakproof seal an '0' ring (located in a waist in the adapter (elbow) is squeezed between a backing nut and the component, junction block etc.

In some instances a plastic retaining (backing) ring is interposed between the nut and the '0' ring and in these cases the nut is recessed to part house the plastic ring.

To prevent damage to the '0' ring, the interfaces (nut, '0' ring and component) are to be well lubricated with hydraulic oil. Similarly, the threads of fittings and block/component.

### A. Installation

(1) Lubricate threads with hydraulic oil and screw nut (if applicable, recess face last) onto fitting until totally above waist.

(2) If applicable, position retaining ring in waist of fitting and unscrew nut until retaining ring can be located in recess of nut.

(3) Lubricate face of nut and, if applicable retaining ring.

(4) Lubricate '0' ring and locate in waist of fitting.

(5) Unscrew nut until '0' ring tight against outer threaded section of fitting. Lubricate threads and face of block/component.

(6) Maintain relative position of nut and fitting and screw fitting into block/component until '0' ring contacts block/component (indicated by increase in torque).

(7) Hold nut relative to block/component and screw in fitting a further one and a half turns.

NOTE : If required alignment not known, operations (8), (9) and (10) may be delayed until block/component located in final position and pipe joints made.

(8) Maintain position of nut relative to block/component and align fitting by screwing into block/component for up to one more turn.

(9) Hold fitting and turn nut until tight against block/component.

(10) Wire lock.

# MAIN SYSTEM - DESCRIPTION AND OPERATION

## 1. General (Fig.1)

### A. Fluid storage

System fluid is stored in a spherical reservoir; fluid contents are indicated by an integral level indicator tube. The reservoir is pressurized by air tapped from both engines upstream of the air conditioning system main air valves. The air is fed to the reservoir via non-return valves, a pressure regulating valve which has an integral relief valve, an inward relief valve and, Mod.252872, an additional non-return valve at the reservoir pressurizing connection. A pressure switch is fitted in the air supply line and wired to an indicator to give indication of reservoir pressurization failure. A temperature switch, mounted on the base of the reservoir, is also wired to an annunciator on the MWS panel, to give indication of system overheat. An outward relief valve is fitted to the reservoir to vent excessive air pressure to atmosphere.

Reservoir pressurization can also be effected from an external source through a ground air connection, the supply route into the reservoir being identical to that for the engine supply.

A drain point is fitted in the line between the suction filter and the hand pump to facilitate draining of the reservoir. A gauze filter is fitted in the reservoir filler neck.

### B. Power generation

Fluid is drawn from the reservoir, through a suction filter, by two variable displacement seven-cylinder pumps driven one by each engine.

Pre Mod.252660: a two-port on/off valve in each suction line is interconnected with the related engine HP fuel cock; isolation of the hydraulic fluid supply is, therefore, simultaneous with engine shut-down. A restrictor in a by-pass round the valve ensures that a limited supply of fluid reaches the pump for lubrication purposes whilst the engine is windmilling with the HP fuel cock off.

Mod.252660: a three-port on/off valve in each suction line is interconnected with the related engine HP fuel cock, hydraulic main system isolation is, therefore, simultaneous with engine shut-down. When a HP fuel cock is selected off, the three-port configuration of the associated on/off valve forms a closed circuit which connects the pressure line of each pump to its suction feed line. This arrangement provides full volume fluid supply at the pumps during engine run-down.

Mod.252689: a ripple suppressor is installed in the pressure line of each pump.

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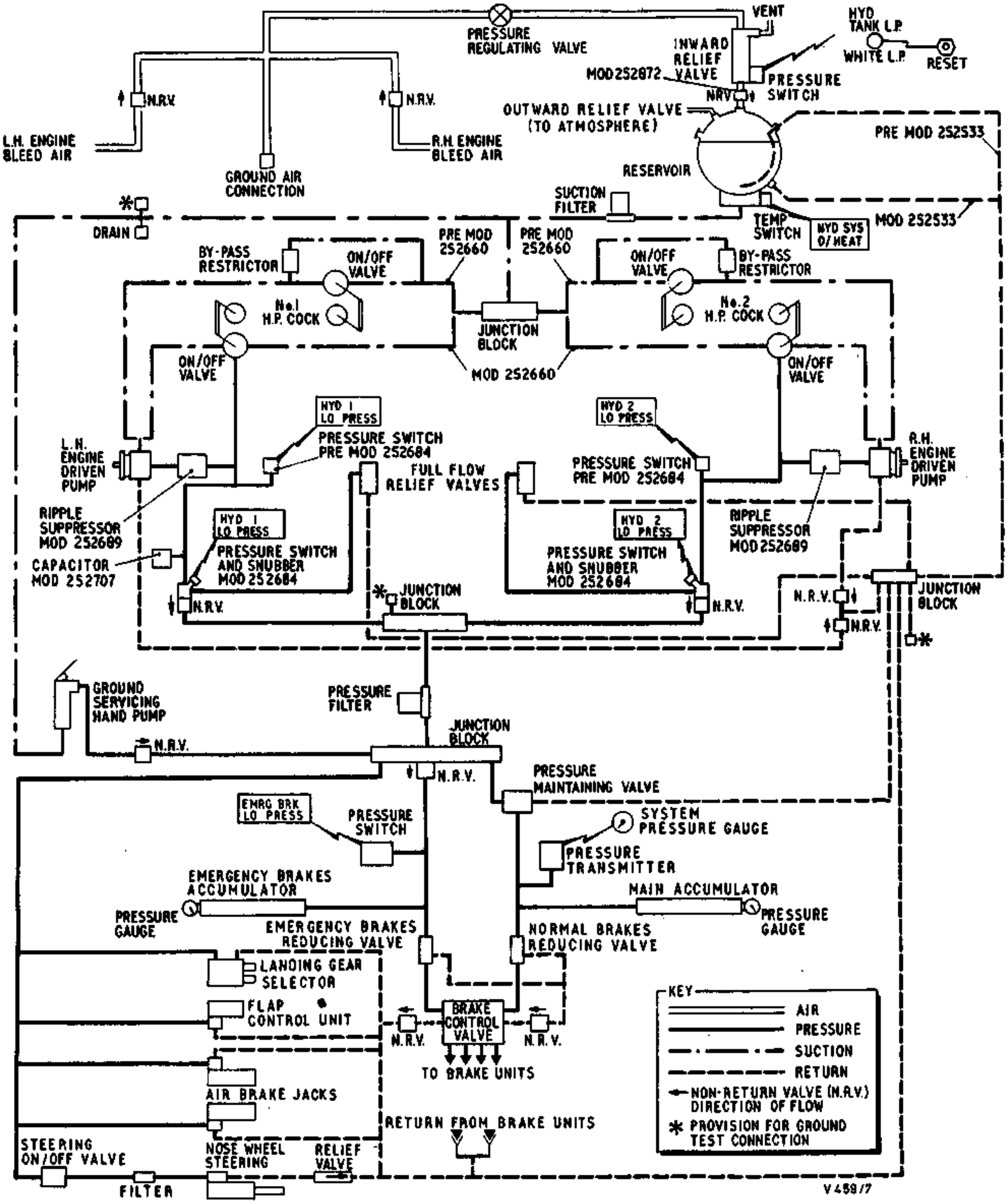
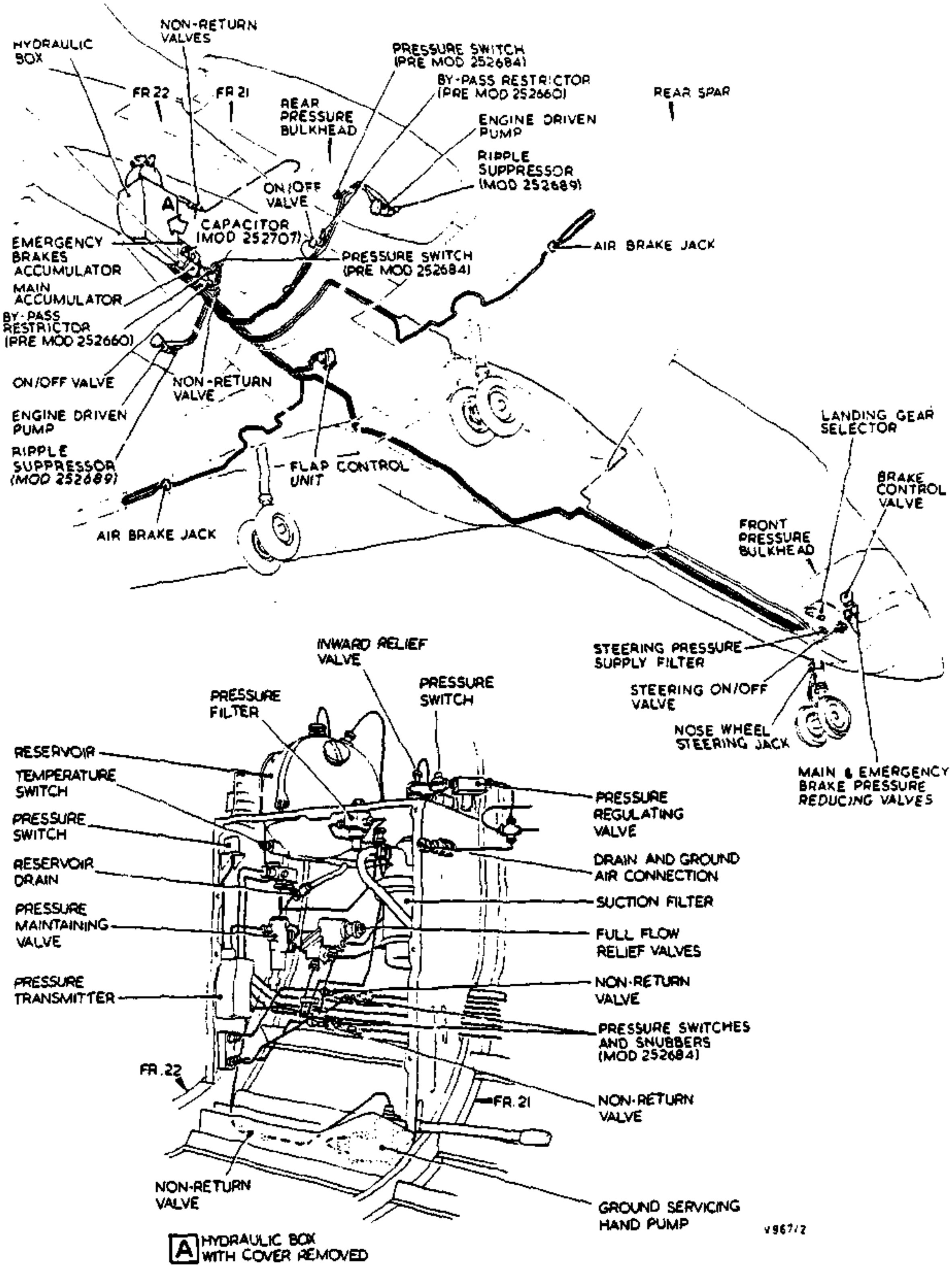


Main system diagram
Fig.1

...Main system - Description and operation continued



Location of main system components
Fig.2

Mod.253531A aircraft are fitted with Dynapower/Stratopower hydraulic pumps with beryllium copper drive couplings. Pre-Mod.253531A aircraft have Dynapower/Stratopower (NYAB) units with steel drive couplings.

The valves are positioned upstream of the system non-return valves, therefore, the failure of one pump causing its associated relief valve to operate and dump the pressure to return, would have no effect on the remaining pump which would continue to pressurize the system.

A pressure filter, incorporating an indicator button which indicates when the element is clogged, is fitted in the common delivery line to the aircraft systems.

### C. Accumulators

Two cylindrical piston-type accumulators, each fitted with a pressure indicator and nitrogen charging valve, are incorporated in the system. One is the main accumulator, providing normal system backing and the other acts as an emergency brake accumulator and stores sufficient pressure for brakes operation in the event of complete system failure. A non-return valve prevents emergency brakes pressure discharging back into the main system. Loss of the normal braking system pressure is prevented by a spring-plunger pressure - maintaining valve. Provided that main system pressure is normal, the valve remains open; if pressure falls below a pre-set value it closes to retain the main accumulator pressure for braking only.

Mod.252707: a hydraulic capacitor, connected into the pressure line from the LH engine-driven pump, is strapped to the main and emergency brakes accumulators.

### D. Hand pump

A piston-type hand pump is provided to enable the system to be pressurized for ground servicing.

### E. Location of components

The majority of hydraulic power system components are grouped together in a hydraulic box in the rear fuselage equipment bay. Location of all components is shown on Fig.2.

## 2. Data

| | |
|---|---|
| Fluid, mineral base .. .. .. | DEF.STAN.91/48/1 (MIL-H-5606) |
| Reservoir capacity .. .. .. | 2 Imp.gal. (2.4 U.S. gal; 9.1 litres) |
| System operating pressure .. .. | 3000 lb/sq.in. |
| Accumulator initial nitrogen pressure .. | 950 to 1000 lb/sq.in. |

NOTE : The difference in readings between the flight compartment indicator the accumulator indicator is not to exceed 150 lb/sq/in.

...Main system - Description and operation continued

Component pressure settings :-

| | |
|---|---|
| Pressure maintaining valve | |
| Opening pressure | 2400 lb/sq.in. |
| Closing pressure | 2200 lb/sq.in. |
| Full flow relief valve | |
| Relief pressure | 4000 lb/sq.in. |
| Re-seat pressure | 400 to 625 lb/sq.in. |
| Pressure regulating valve | |
| Inlet pressure | 120 lb/sq.in. |
| Outlet pressure | 15 ± 1 lb/sq.in. |
| Reservoir outward relief valve | |
| Relief pressure | 18 ± 1 lb/sq.in. |
| Re-seat pressure | 15 lb/sq.in. (min.) |
| Reservoir inward relief valve | 1 ± 0.25 lb/sq.in. |
| Relief valve in suction filter | 4 to 6 lb/sq.in. |

* * *

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## MAIN SYSTEM - TROUBLE SHOOTING

| Fault | Possible cause | Remedy |
|---|---|---|
| 1.Low system pressure indicated on flight compartment indicator with both pumps operating. If indicated pressure is less than 1500 ± 50 lb/sq.in.HYD LO PRESS annunciators should light. | (a) Low fluid level in reservoir. | (a) Top up reservoir and check system for leaks. |
| | (b) Pressure indicating system faulty - cross check flight compartment indicator with main accumulator pressure gauge. | (b) Remove and bench test indicator*. If indicator serviceable, remove and bench test transmitter*. |
| | (c) Pressure maintaining valve faulty. | (c) Install a serviceable pressure maintaining valve. |
| 2.System slow to build up to operating pressure. | (a) Blockage or restriction in suction supply to pumps. For example, suction filter blocked, on/off valve incorrectly adjusted, pipes blocked. | (a) Trace and clear blocked pipe, renew suction filter element* and check filter relief valve operation, or adjust on/off valve controls*. |
| | (b) Pressure filter blocked. | (b) Renew or clean pressure filter element. |
| 3.System fails to build up to operating pressure on one pump. | (a) Internal faults or drive failed to associated pump. | (a) Install a serviceable pump*. |
| | (b) Faulty hydraulic on/off valve or controls require adjustment. | (b) Check on/off valve operation. Install a serviceable on/off valve* and/or adjust controls*. |
| | (c) NRV in the delivery line failed in the closed position. | (c) Replace NRV*. |

NOTE : Refer to Table of Contents for maintenance procedures relating to components marked with an asterisk (*).

| Fault | Possible cause | Remedy |
|---|---|---|
| 4. High system pressure indicated on flight compartment indicator. | (a) Pressure indicating system faulty - cross check flight compartment indicator with main accumulator pressure gauge. | (a) Remove and bench test indicator*. If indicator serviceable, remove and bench test transmitter*. |
| | (b) One or both pumps failing to control at correct pressure setting. | (b) Install serviceable pump(s)*. |
| 5. HYD 1 (or 2) LO PRESS annunciator lights during normal system operation. | (a) Faulty electrical connections to pressure switch or annunciator. | (a) Trace and connect faulty connections. |
| | (b) Faulty pressure switch and/or (Mod.252684) snubber. | (b) Install a serviceable pressure switch* and/or (Mod.252684) snubber. |
| | (c) No delivery from related pump. See 3 (a) and (b) preceding. | |
| 6. HYD 1 and 2 LO PRESS annunciators not lit when a suitable electrical ground power supply is connected to the aircraft and the hydraulic system is unpressurized. | (a) As for 5(a) and (b) preceding. | (a) As for 5 (a) or (b) preceding. |
| | (b) Faulty annunciator filament. | (b) Install a serviceable filament. |
| 7. Emergency brakes system leak rate excessive. | (a) Non-return valve defective. | (a) Install a serviceable non-return valve. |
| | (b) Emergency reducing valve leaking internally. | (b) See Chapter 32, EMERGENCY REDUCING VALVE TROUBLE SHOOTING. |

NOTE : Refer to Table of Contents for maintenance procedures relating to components marked with an asterisk (*).

| Fault | Possible cause | Remedy |
|---|---|---|
| 8.HYD SYS O HEAT annunciator lit during normal operation. | (a) Excessive seepage return from system components. | (a) Locate and change faulty components.<br>NOTE : Locate the faulty component by carrying out TEST 1 to 7. |
| 9.HYD TANK LP Indicator shows white after normal flight, see (a) to (f). | (a) Oleo microswitch operated with aircraft on the ground while hydraulic tank was depressurized and electrics were on. | (a) Reset indicator and check after next flight. |
| | (b) Pressure switch failed in low pressure mode. | (b) Replace faulty switch. |
| | (c) Indicator or indicator circuit fault. | (c) Replace faulty indicator or repair circuit. |
| | (d) Tank or associated system is leaking. | (d) Replace or repair faulty item. |
| | (e) Pressure regulating valve (PRV) failed in low pressure mode. | (e) Replace faulty PRV. |
| | (f) Faulty electrical connections to pressure switch or indicator. | (f) Trace and correct faulty connections.<br>NOTE : Locate the faulty component by carrying out TEST 8. |

## TEST 1 - POWER CIRCUIT

(a) Blank supply to junction block downstream of pressure filter. Disconnect one pump and pressurize hydraulic system using a ground rig.

IF OK - Reconnect supply and effect test 1 (b).

IF NOT OK - Check flow relief valves for excessive seepage to return:-

Full flow relief valve - 30cc/minute max.

Install a serviceable unit.

(b) Remove blank from junction block as specified in 1(a). Blank supply to 'normal' brakes main reducing valve and to other aircraft services. Pressurize hydraulic system as specified in 1(a).

IF OK - Reconnect supply and effect Test 2 or 3

IF NOT OK - Check following for excessive seepage to return:-

Pressure maintaining valve - 8cc/minute max.

Install a serviceable unit and check system pressure decay time:-

2800-2600 p.s.i. in more than 20 seconds.

## TEST 2 - BRAKES SYSTEM (Rapid system pressure decay time - brakes off)

(a) Disconnect exhaust line from 'normal' brakes main reducing valve. Pressurize hydraulic system and check for continuous seepage to return from exhaust connection.

IF OK - Reconnect exhaust line and effect Test (b).

IF NOT OK - Install a serviceable unit and check pressure decay time.

(b) Disconnect exhaust line from brake control valve. Pressurize hydraulic system and check for seepage from the exhaust connection.

IF OK - Reconnect line and effect Test 4, 5 or 6.

IF NOT OK - Install a serviceable unit and check pressure decay time.

## TEST 3 - BRAKES SYSTEM (Rapid pressure decay time - brakes on)

(a) Ensure that WHEEL BRAKE lever is at normal (fully forward) position. Pressurize hydraulic system.
Operate rudder hard over to right and depress right brake pedal. Shut down ground rig and check system pressure decay time (2800-2600 p.s.i. in more than 20 seconds with brake pedal depressed).

IF OK - Repeat for left brakes.

IF NOT OK - Check maxaret units and shuttle valve for leaks. Install serviceable unit(s) (see Chapter 32, MAXARET INSTALLATION) and check pressure decay time.

(b) Select WHEEL BRAKE lever to PARK.
Pressurize hydraulic system, shut down ground rig and check pressure decay time.

IF OK - Effect Test 4, 5, 6 or 7.

IF NOT OK - Check emergency brake pressure reducing valve and brake control valve for leaks at exhaust connections.

Check shuttle valves for leaks through to normal lines.

Install serviceable unit(s) and check pressure decay time.

## TEST 4 - LANDING GEAR

**CAUTION : ENSURE ALL RELEVANT SAFETY PRECAUTIONS ARE OBSERVED.**

(a) Operate landing gear emergency selector (labelled PULL EMERG U/C ) to the emergency position (this isolates all landing gear components, less nosewheel steering, from system pressure).
Pressurize hydraulic system and check pressure decay time (2800-2600 p.s.i. in more than 20 seconds.

IF OK - Effect Test (b), (c), (d) and (e).

IF NOT OK - Effect Test 5, 6 or 7.
Return selector to 'normal' position.

...Main system - Trouble shooting continued

TEST 4 - LANDING GEAR continued

(b) Disconnect link to auxiliary system on/off valve in roof of nosegear bay.
Push on/off valve in to the off position, ensuring that dump valve is not disturbed.
Pressurize hydraulic system and check decay time.

IF OK - Check main gear retraction jack shuttle valves for leaks. If necessary, install serviceable unit(s).

Reconnect link with valve pulled out to the 'on' position.

Check decay time.

IF NOT OK - Effect Test (c), (d) and (e).

(c) Disconnect gear retraction jacks return line at selector valve (connection adjacent to selector valve fork end).
Pressurize hydraulic system and check for leakage in excess of 4cc/minute from return line.

IF OK - Reconnect lines and effect Test (d) and (e).

IF NOT OK - Check each jack individually and, if necessary install serviceable jack(s) (see Chapter 32, LANDING GEAR).

Check decay time.

(d) Disconnect drain lines from reversing valves.
Pressurize hydraulic system and check for leaks in excess of 10cc/minute.

NOTE : Before rejecting a leaking valve, check that it is correctly rigged. A clearance of 0.50 in. between plunger flange and body, with gear locked down, is critical from the leakage aspect.

IF OK - Reconnect lines and effect Test (e).

IF NOT OK - Install serviceable valve(s) (see Chapter 32, REVERSING VALVES).

Check decay time.

(e) Disconnect return lines at door jacks.
Pressurize hydraulic system and check for leaks across jack positions.

IF OK - Reconnect lines.

IF NOT OK - Install serviceable jack(s)
Check decay time.

...Main system - Trouble shooting continued

## TEST 5 - NOSEWHEEL STEERING

Disconnect return line from nosewheel steering jack.
Pressurize hydraulic system.
With selector valve in neutral, check for seepage in excess of 8cc/minute from return connection.

IF OK - Reconnect line and effect Test 6 or 7.

IF NOT OK - Install serviceable jack (see Chapter 32, STEERING JACK).

Check decay time.

## TEST 6 - FLAP SYSTEM

Disconnect the exhaust and drain lines at the flap control unit.
Pressurize hydraulic system and check that the combined leak rate from these two connections is not in excess of 100cc/minute with unit in neutral.

IF OK - Reconnect lines.

IF NOT OK - Install serviceable unit (see Chapter 27, FLAP CONTROL UNIT).

Check decay time.

## TEST 7 - AIR BRAKES

Disconnect return lines from airbrake jacks.
Pressurize hydraulic system.
Check, with selector valves in neutral, for seepage in excess of 10cc/minute.

IF OK - Reconnect lines.

IF NOT OK - Renew faulty jack(s) (see Chapter 27, AIRBRAKE JACKS).

Check decay time.

## TEST 8 - HYDRAULIC TANK PRESSURIZATION

(a) If no obvious fault in the tank pressurisation system is evident, reset indicator and check immediately after next flight.

Indicator shows black - warning was probably caused by operation of the landing gear oleo microswitch while aircraft was on the ground and electrics were on.

Indicator shows white - Effect Test (b).

...Main system - Trouble shooting continued

TEST 8 - HYDRAULIC TANK PRESSURIZATION continued

(b) Ensure tank is depressurized.
Remove tank pressure switch.
Check switch for correct operation :-
Switch closes by 10 lb/sq.in. (decreasing pressure)
Switch opens by 11 lb/sq.in. (increasing pressure)

IF OK - Effect test (c).

NOT OK - Replace faulty switch.

(c) Fit a suitable pressure gauge (Range 0-20 lb/sq.in.) into pressure switch connection on tank.
Either connect a ground compressor, capable of pressurizing the circuit to at least 20 lb/sq.in., to the ground air connection or run an engine at 65% N1 r.p.m.

Check for air leaks from piping and tank, including tank inward and outward relief valves.

Pressure gauge shows 14-16 lb/sq.in. - Check indicator and associated electrical circuit.

Pressure gauge shows less than 14 lb/sq.in. - Replace faulty pressure regulating valve.

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## MAIN SYSTEM - MAINTENANCE PRACTICES

WARNING: 1. BEFORE PRESSURIZING THE HYDRAULIC SYSTEM - MAKE SURE THAT THE CONTROLS MATCH THE COMPONENT POSITIONS.

2. LANDING GEAR - MAKE SURE THAT GROUND LOCKING PINS AND CHOCKS ARE INSTALLED.

3. FLYING CONTROL SURFACES - MAKE SURE THAT THE TRAVEL RANGE IS CLEAR.

4. BE CAREFUL WITH THE HYDRAULIC SYSTEM, IT IS PRESSURIZED. RELEASE THE PRESSURE SLOWLY, A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY.

5. BEFORE DISMANTLING ANY PART OF THE HYDRAULIC SYSTEM MAKE SURE THAT ALL HYDRAULIC PRESSURE IS RELEASED.

6. BE CAREFUL WHEN YOU USE THE HYDRAULIC FLUID - WEAR PROTECTIVE CLOTHING AND SAFETY GOGGLES. HYDRAULIC FLUID CAN CAUSE DAMAGE TO THE SKIN AND EYES.

CAUTION: 1. WHEN A TEST RIG IS CONNECTED TO THE AIRCRAFT, MAKE SURE THE HYDRAULIC FLUID IN THE TEST RIG IS THE SAME TYPE AS THE HYDRAULIC FLUID IN THE AIRCRAFT SYSTEM. INCORRECT HYDRAULIC FLUIDS CAN CAUSE DAMAGE TO SYSTEM COMPONENTS WITH POSSIBLE ADVERSE RESULTS.

2. HYDRAULIC FLUID DRAINED OR BLED FROM AIRCRAFT SYSTEMS IS TO BE DISCARDED. USE ONLY NEW HYDRAULIC FLUID WHEN REPLENISHING AIRCRAFT OR GROUND SERVICING RIGS.

3. RESIDUES OF CHLORINATED SOLVENTS, IF MIXED WITH WATER FORM HYDROCHLORIC ACID AND CAN CAUSE CORROSION. TRICHLOROETHYLENE AND OTHER CHLORINATED SOLVENTS MUST NOT BE USED TO CLEAN ANY PART OF HYDRAULIC OR OTHER PIPED SYSTEMS.

## 1. Servicing

### A. Release hydraulic pressure

WARNING: WHEN HYDRAULIC PRESSURE IS RELEASED, THE HYDRAULICALLY OPERATED MAIN GEAR DOORS MAY DROOP. ON SUBSEQUENT PRESSURIZATION OF SYSTEM, DOORS WILL RETURN SMARTLY TO THE CLOSED POSITION. AS A SAFEGUARD TO PERSONNEL WORKING ON OR IN THE VICINITY OF MAIN GEAR IT IS RECOMMENDED THAT SPECIAL DOOR CLAMPS (HSA.25Y1491A) BE FITTED TO THE DOOR JACKS TO RETAIN THE DOORS IN THE OPEN POSITION.

NOTE: A 28 volt d.c. ground supply must be connected to the aircraft to obtain readings on the system pressure indicator.

(1) Main accumulator:

Due to the operation of the pressure maintaining valve, release pressure from the main system accumulator in two stages as follows:

(a) Operate flaps or airbrakes until system pressure indicator reading falls to 2300 ± 50 p.s.i.

NOTE: If it is necessary to move the flaps or airbrakes subsequent to pressure release, make the appropriate control selection and operate the main system handpump until the required setting is obtained.

(b) With the WHEEL BRAKE lever at NORMAL (fully forward), operate the foot brake pedals until, with the brakes fully applied, zero pressure is indicated on both brake indicators.

(2) Emergency brake accumulator:

Set the WHEEL BRAKE lever to EMERG and operate the foot brake pedals until the emergency brake accumulator gauge reads 950 to 1000 p.s.i.

(3) Release reservoir air pressure by slowly removing filler cap.

### B. Prime system

The system is virtually self-priming; any air trapped in the remainder of the system can be eliminated by repeated operation of the hydraulic services using the hand pump.

### C. Charge accumulators

(1) Release hydraulic pressure (see Para.1.A).

(2) Check that accumulator pressure indicators read 950 - 1000 p.s.i.

(3) If necessary, charge accumulators through the charging valves, using a supply of nitrogen. Admit nitrogen slowly to prevent damage to the accumulators and to prevent false readings due to overheating.

(4) After charging, check the charging valves for leaks.

## 2. Removal/Installation

### A. General

Removal and installation of the majority of main system units is self evident. Units which require special coverage are dealt with under the Page 201 block of their respective subject numbers; refer to Chapter Table of Contents. Where no specific instructions are given, observe the following basic principles:

(1) Release hydraulic pressure before unit removal or pipeline disconnection (see Para.1.A.).

(2) Take adequate precautions to avoid fluid spillage.

(3) Blank off all disconnected pipelines and components.

(4) Lubricate the threads of all hydraulic pipe connections with hydraulic fluid (Item 107, Ref. AMM 20-95-101).

(5) Lubricate the threads of all associated pneumatic pipe connections with Restorseal 15 (MIL-T-5542D).

(6) After installation, use the main system handpump to prime the system, then check for leaks and functionally test the appropriate part of the system. Lock bolts and unions.

(7) After installation of a pressure switch or pressure transmitter, bleed the pipe to the unit by leaving the hydraulic connection slack, during handpump operation, until there is a flow of air free fluid from the connection. Tighten and lock union.

## 3.Adjustment/Test

CAUTION: WHEN THE MAIN GEAR IS FUNCTIONED, DO NOT APPLY THE HYDRAULIC POWER UNTIL THE DOOR JACK CLAMPS (25Y1491A) ARE REMOVED AND DOORS MANUALLY CLOSED.

### A.Test main system with test-rig

WARNING: WHEN A TEST RIG IS CONNECTED TO THE AIRCRAFT, MAKE SURE THE HYDRAULIC FLUID IN THE TEST RIG IS THE SAME TYPE AS THE HYDRAULIC FLUID IN THE AIRCRAFT SYSTEM. INCORRECT HYDRAULIC FLUIDS CAN CAUSE DAMAGE TO SYSTEM COMPONENTS WITH POSSIBLE ADVERSE RESULTS.

Equipment and materials:

| Equipment/Material | Item No./Source |
|---|---|
| Equipment test rig | 25YTS383R |
| Warning signs: KEEP CLEAR OF THE LANDING GEAR AND FLIGHT CONTROLS. | Local |
| Hydraulic fluid | Item 107 (Ref. AMM 20-95-101) |

NOTE: Any suitable alternative test rig can be used, provided it is capable of reproducing the same pressure and flow rate as the aircraft pump, that is, 3.2 Imp.gall/min. at 3000 p.s.i. and having the facility of supplying air at a pressure of 15 p.s.i.

(1) Jack and level the aircraft (see chapter 7, LIFTING AND SHORING).

(2) Release hydraulic pressure (see Para.1.A.), ensure that the accumulators are fully charged (see Para.1.C.) and the hydraulic reservoir correctly filled (see chapter 12, SERVICING - HYDRAULIC).

(3) Move all objects well clear of the landing gear and other movable surfaces. Set suitable warning notices at prominent points around the aircraft. Remove landing gear locking pins.

(4) Disconnect the hoses of one engine driven pump at the couplings on the bracket on the associated pod fillet; connect the pressure, return and drain hoses of the test rig to the pressure, suction and case drain couplings on the pod fillet bracket. Connect the test rig air line to the ground air connection and connect the test rig electrical connections to a suitably earthed socket.

(5) Ensure that all aircraft electrical circuits are safe, then connect a suitable ground power supply to the aircraft system (see chapter 24, GENERAL). Open throttles beyond the 70% r.p.m. position.

(6) Use the main system handpump to check all services for correct operation and structural clearances; check the system for leaks. Leave the landing gear selected DOWN, airbrakes SHUT, flaps UP (0°) and parking brake applied.

(7) Set the related HP fuel cock ON. Start the test rig pump. Close and open the rig release cock and check that the related HYD LO PRESS annunciator on the MWS panel goes out when the main system pressure reads 1750 p.s.i.

(8) Check that the EMER BRK LO PRESS annunciator on MWS panel goes out at 2250 to 2450 p.s.i. rising pressure.

(9) Reset HYD TANK LP indicator, adjacent to reservoir, and ensure that it shows 'black'.

(10) Check accumulators charge to not less than 2900 p.s.i. Stop the test rig and check that the time taken for the main accumulator pressure to drop from 2800 p.s.i. to 2600 p.s.i. is not less than 25 seconds. Restart test rig.

(11) Following installation of nose gear or hydraulic hoses in nose gear bay, disconnect nose gear doors and raise landing gear. Check that there is no fouling of the gear with the hydraulic hoses, especially where the drag stay passes the jack hoses.

(12) Connect nose gear doors, tighten nuts and lock with split pins.

(13) Raise and lower the landing gear. Check that the landing gear annunciator lights illuminate in the correct sequence, that is:

| | |
|---|---|
| Gear locked UP | : No lights. |
| Gear unlocked, raising or lowering | : Three red lights |
| Gear locked DOWN | : Three green lights. |

Check that the following operating times are not exceeded:

| | |
|---|---|
| Gear DOWN TO UP | : 6 seconds. |
| Gear UP to DOWN | : 6 seconds. |

Check that the landing gear mechanical indicators operate correctly (see Chapter 32, MECHANICAL INDICATING SYSTEM).

(14) Check that the HYD TANK LP indicator still shows 'black'.

(15) Reduce nose gear oleo inflation pressure to 25 p.s.i. (see Chapter 12 SERVICING - LANDING GEAR). Operate the nose wheel steering from stop to stop and check operation is smooth.

(16) Stop test rig and release hydraulic pressure (see Para.1.A.).

(17) Select landing gear UP and pump on system handpump until nose gear lock is just broken.

(18) Select auxiliary hydraulic system by pulling selector handle labelled PULL EMERG U/C.

(19) Select landing gear DOWN.

(20) Start test rig and check that, with nose gear still unlocked, the nosewheel steering is inoperative.

(21) Re-set the auxiliary system dump valve by returning the emergency handle to the normal (fully in) position. The landing gear will now move to the locked down position.

(22) Check that the nosewheel steering system now operates correctly as in operation (15).

(23) Re-inflate the nose gear oleo to correct pressure (see Chapter 12, SERVICING - LANDING GEAR).

(24) Operate flaps over full range of movement; check that the following operating times are not exceeded:

| | |
|---|---|
| Flaps UP (0°) to LAND (45°) .. | .. 11 - 14½ seconds. |
| Flaps LAND (45°) to UP (0°) .. | .. 5 - 10 seconds. |

(25) Operate airbrakes; check that the following operating times are not exceeded:

| | | |
|---|---|---|
| Airbrakes SHUT to OPEN | .. .. | 1 second. |
| Airbrakes OPEN to SHUT | .. .. | 1 second. |

(26) Select flaps to LAND (45°) and airbrakes to OPEN.

(27) Operate flaps to and from the lift dump position by moving the airbrake selector back to DUMP and then forward to the airbrakes OPEN position. Check that the following operating times are not exceeded:-

| | | |
|---|---|---|
| Flap LAND (45°) to lift dump position | .. | 2 seconds |
| Flaps lift dump position to LAND (45°) | .. | 2½ seconds |

(28) Select landing gear UP with flaps in the landing position and check that the warning horn sounds. Select landing gear DOWN and check that the horn ceases to operate when the landing gear is down and locked.

Select flaps up (0°) and landing gear UP.

(29) Close and open each throttle in turn and check that with only one throttle below the 60% N1 r.p.m. position, the warning horn sounds.

(30) Press the HORN ISOLATE button and check that the horn signal is cancelled. Reset the horn system by opening throttles and check that the horn again sounds with the throttles closed to below the 60% N1 r.p.m. position.

(31) Select landing gear DOWN and check that the horn signal ceases when the gear is down and locked.

(32) Stop the test rig and check that the related HYD LO PRESS annunciator lights.

(33) Operate the main services to exhaust system pressure. Check that main accumulator pressure does not fall below 2300 ± 50 p.s.i. until the normal wheel brakes are operated.

NOTE: The main accumulator pressure leakage must not be more than 50 p.s.i. in one hour.

(34) Set the WHEEL BRAKE lever to the NORMAL (fully forward) position. Depress each foot brake pedal in turn and then together; check that, in each case, the pressure shown on the brake pressure indicator is between 1750 and 1900 p.s.i.

(35) Release the remainder of the main accumulator pressure by operating the foot brake pedals.

(36) Check that the pressure in the emergency brakes accumulator has been maintained at not less than 2900 p.s.i. Set the WHEEL BRAKE lever to EMERG. Operate the foot brake pedals to exhaust pressure in the emergency brakes accumulator. Check that, with each brake application the WHEEL EMERG PRESS magnetic indicators show ON, and that the EMRG BRK LO PRESS annunciator lights when the accumulator pressure falls to between 2400 and 2250 p.s.i.

(37) Close the HP fuel cock. Disconnect the test rig. Connect the hoses of the aircraft hydraulic pump to the couplings on the pod fillet bracket.

(38) Ensure that flaps are UP, airbrakes are SHUT and landing gear is selected DOWN and locked. Use the main system handpump to achieve these conditions if necessary. Check reservoir contents and replenish as necessary.

(39) Disconnect the ground power supply.

(40) Fit landing gear locking pins and lower the aircraft.

NOTE: On the next engine run, check correct operation of the HYD LO PRESS annunciator not proved during the above test.

## 8. Test main system using aircraft engines

### Preliminary actions

(1) Release hydraulic pressure, check the initial nitrogen pressure in the main accumulator and emergency brake accumulator and charge as necessary. Check the reservoir fluid level and replenish as required (see Chapter 12, SERVICING - HYDRAULIC).

(2) Pressurize the emergency brake accumulator to 1750 p.s.i. using the handpump, to provide sufficient parking brake pressure during starting.

(3) Check that HYD 1 LO PRESS and HYD 2 LO PRESS annunciators light when electrical ground power is connected.

The following tests are to be made during ground running of the engines. To check the efficiency of each engine-driven pump, run each engine separately.

### Test with engine running

See Chapter 71 for all engine handling procedures.

(4) After starting the engine check that the associated HYD LO PRESS annunciator light goes out and that the other engine HYD LO PRESS annunciator remains on.

(5) Check that the EMRG BRK LO PRESS annunciator light goes out when the emergency brake accumulator pressure gauge reads 2250 to 2450 p.s.i.

Test after engine shut-down

(6) With a 28 volt d.c. ground supply connected, operate flaps or airbrakes until main system pressure indicator reading falls to 2300 ± 50 p.s.i. Check that the emergency brake accumulator indicator now reads not less than 2900 p.s.i. and the main system accumulator indicator 2300 p.s.i.

(7) Set the WHEEL BRAKE lever to EMERG, and release pressure from the emergency brake accumulator by operating the foot brake pedals. Check that the EMRG BRK LO PRESS annunciator lights at 2400 to 2250 p.s.i. and that the WHEEL BRAKES L and R EMRG annunciators light with each brake application.

(8) Check all units and pipelines for leaks.

## 4. Inspection/Check

### A. Check emergency brake system leak rate

(1) Ensure that emergency brake accumulator is fully charged with nitrogen (see Para.1.C.).

(2) Using test rig, or by running engines, pressurize hydraulic system.

(3) Release pressure from the main system accumulator (see Para.1.A.).

(4) Check that the emergency brake accumulator pressure is between 2900 and 3050 p.s.i. and note exact reading.

(5) Check that the emergency brake system pressure drop, as read on the emergency brake accumulator indicator, does not exceed 50 p.s.i. in one hour.

## 5. Cleaning/Painting

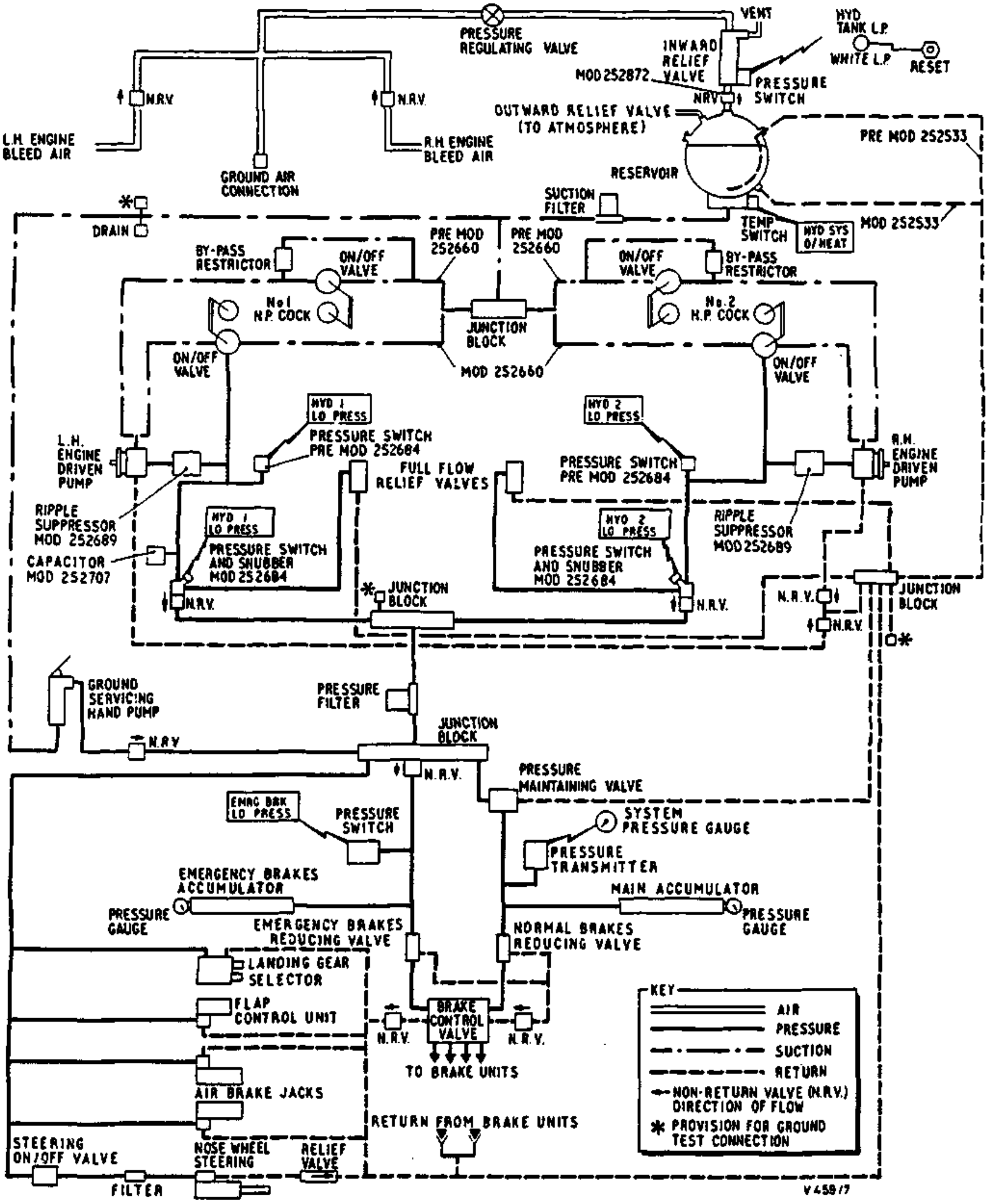
### A. Cleanse system of contamination following failure of engine-driven pump (Fig.201)

(1) Release hydraulic pressure (see Para.1.A.).

(2) Remove the hydraulic reservoir and thoroughly clean internally.

(3) Remove the pump non-return valve, pressure switch, snubber (Mod.252684), ripple suppressor (Mod.252689), full flow relief valve, and capacitor (Mod.252707) if a left engine pump failure.

(4) Remove and clean pump case drain line non-return valve.



Main system diagram
Fig.201

(5) Remove suction and pressure filter assemblies, discard the elements, and strip and clean housings.

(6) Flush the following pipelines, in the normal direction of flow, with hydraulic fluid filtered through a 5 micron absolute filter:

(a) Reservoir to suction filter.
(b) Pump to non-return valve.
(c) Non-return valve to full flow relief valve.
(d) Full flow relief valve to junction block.
(e) Non-return valve to junction block.
(f) Junction block to pressure filter.
(g) Return line from junction block to reservoir.
(h) Left engine pump failure only - capacitor supply pipe (Mod.252707).
(j) Pump case drain from pump to non-return valve.
(k) Pump case drain from non-return valve to return junction block.

(7) Re-assemble system, using serviceable components in place of those removed in operation (3). Fit new elements to filters and refit filter assemblies.

(8) Refit reservoir and replenish with clean hydraulic fluid (see Chapter 12, SERVICING - HYDRAULIC).

(9) With engine running, prime system by selecting flaps through six complete cycles.

(10) Check pipelines and components for leaks.

(11) Check fluid level in reservoir and replenish as necessary.

(12) Test main system using aircraft engine (see Para.3.B.).

B. Cleanse system of contamination following flap control motor failure

(1) Release hydraulic pressure (see Para.1.A.).

(2) Remove hydraulic reservoir and thoroughly clean internally.

(3) Remove suction filter assembly, discard the element, and strip and clean the housing.

(4) Flush the following pipelines, in the normal direction of flow, with hydraulic fluid filtered through a 5 micron absolute filter:-

(a) Reservoir to suction filter.
(b) Return line from flap control unit to junction block.
(c) Return line from junction block to reservoir.

(5) Re-assemble system; refit suction filter assembly using new element.

(6) Install reservoir and replenish with clean hydraulic fluid (see Chapter 12, SERVICING - HYDRAULIC).

(7) Prime system by operation of flaps through three complete cycles using ground servicing handpump. Check pipelines and components for leaks.

(8) Check fluid level in reservoir and replenish as necessary.

## RESERVOIR ASSEMBLY - MAINTENANCE PRACTICES

### 1.Removal/Installation

#### A.Remove reservoir

(1) On panel ZK, in the rear equipment bay, remove fuse F1 on Series 600 and 700 aircraft; F49 on other Series aircraft.

(2) Release hydraulic pressure from the system (see Chapter 29, MAIN SYSTEM).

(3) Drain reservoir at drain point in hydraulic box.

(4) Disconnect electrical cables from temperature switch.

(5) Disconnect all pipe connections at the reservoir.

(6) Remove reservoir strap-retaining bolt. Remove strap.

(7) Remove locating bolt at lower adapter of level indicator tube.

(8) Withdraw reservoir assembly and blank off all connections.

#### B.Install reservoir

(1) Install temperature switch, outward relief valve and (Mod.252872) pressurizing connection non-return valve if not already fitted to reservoir.

(2) Ensure that packing is in place and intact, and position reservoir in top of hydraulic box.

(3) Align hole in level indicator tube lower adapter with hole in label bracket and fit locating bolt.

(4) Attach and tighten securing strap, ensuring that packing is in place and intact.

(5) Connect all pipe connections.

(6) Fill reservoir (see Chapter 12, SERVICING - HYDRAULIC) and check for leaks.

(7) Connect electrical cables to temperature switch.

(8) Refit fuse.

(9) Run engine and operate flaps and airbrakes several times over full range; check for satisfactory operation and that operating times are as detailed in Chapter 29, MAIN SYSTEM. Check for leaks and replenish reservoir as necessary after engine shut down.

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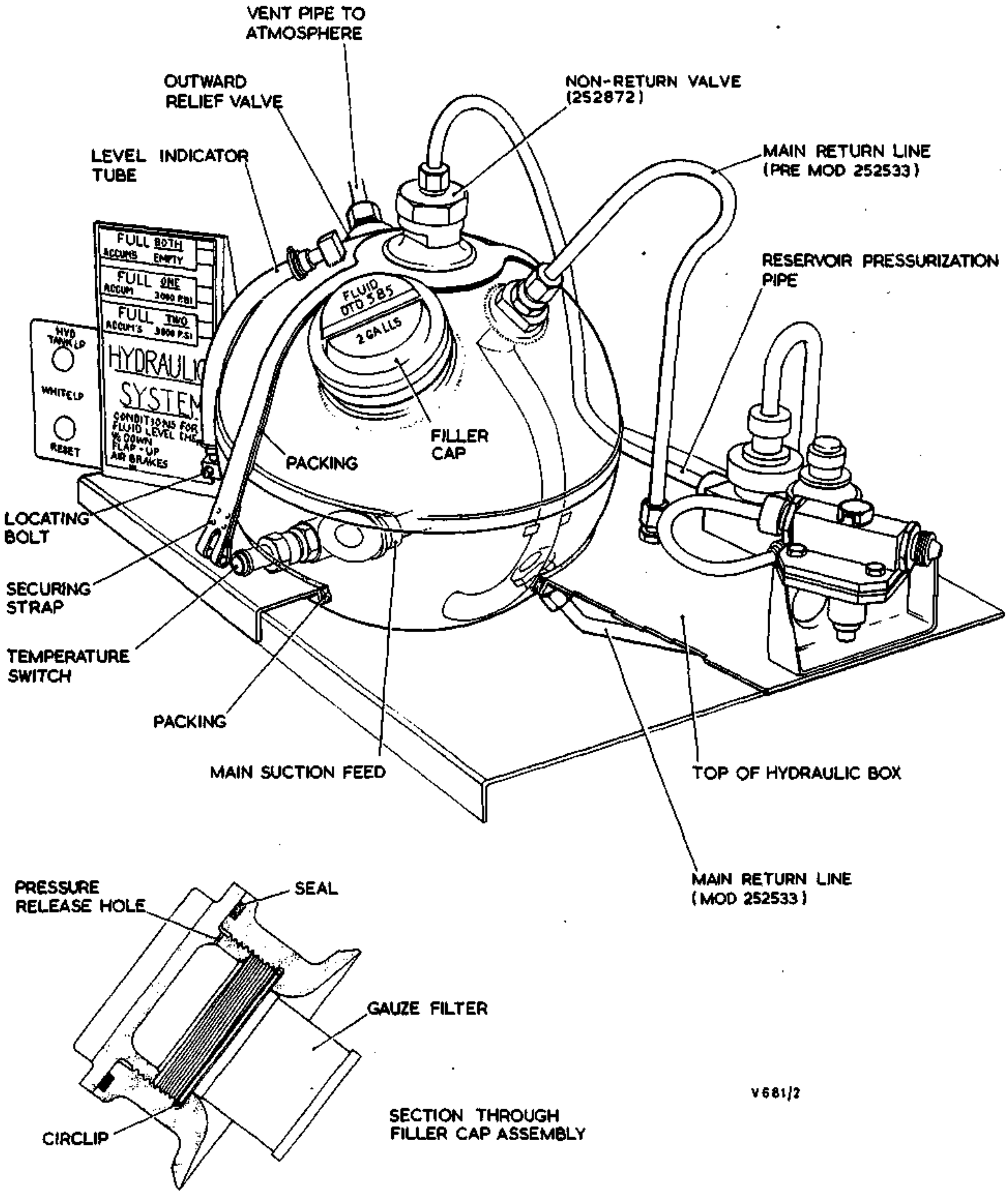

Reservoir assembly
Fig.201

## 2. Adjustment/Test

### A. Functionally test reservoir non-return valve (Mod.252872)

(1) In rear equipment bay, connect air pressure rig to reservoir ground air connection.

(2) Switch rig on and pressurize reservoir to 15 lb./sq.in.

(3) Switch rig off.

(4) Slowly undo pipe joint at non-return valve on top of reservoir and disconnect pressurizing pipeline.

(5) Using leak testing solution, check that no air is escaping from valve inlet.

(6) Slowly undo reservoir filler cap to release air pressure from cap bleed hole.

(7) Refit pipe to valve inlet and secure. Screw down filler cap.

(8) Repeat operation (2) and check for leaks at non-return valve inlet pipeline connection.

(9) Switch off rig and disconnect from ground air connection.

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## SUCTION FILTER - MAINTENANCE PRACTICES

### 1. Unit servicing

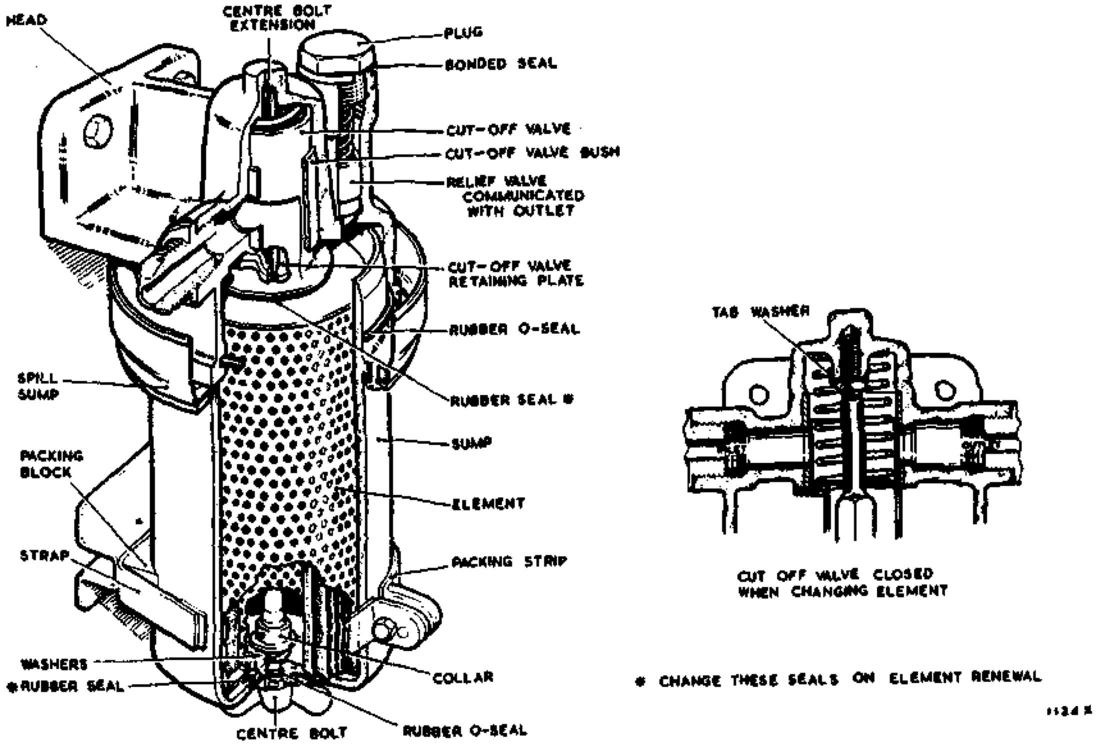
#### A. Remove suction filter element

(1) Remove the clamping bolt on the strap around the filter sump.

(2) Support the sump and unscrew the centre bolt until the sump is released from the filter head. The cut-off valve will prevent loss of system fluid.

(3) Remove filter element and examine for evidence of system component failure.

NOTE: The element in the suction filter cannot be cleaned and must be renewed.



Suction filter
Fig. 201

(4) Remove the fluid from the sump and clean the sump.

B. Install suction filter element

(1) Insert new filter element and two new filter seals, refer to Fig.201, and prime sump with fresh hydraulic fluid, Specification DTD 585.

(2) Refit sump, tighten up and wire-lock centre bolt. Position the strap around the sump and replace and tighten the clamping bolt.

(3) Run engine and operate flaps and airbrakes several times over full range; check for satisfactory operation and that operating times are as detailed in Chapter 29, MAIN SYSTEM. Check for leaks and replenish reservoir as necessary after engine shut-down.

* * *

## ON/OFF VALVE - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove valve

(1) Release hydraulic pressure (see Chapter 29, MAIN SYSTEM).

(2) Drain reservoir.

NOTE : As an alternative to reservoir draining, removal of the suction filter sump will, by operating the filter cut-off valve, isolate the reservoir from the on/off valves (see Chapter 29, SUCTION FILTER). If this method is adopted ensure that contamination of the element does not occur.

(3) Remove pipe covers.

(4) Disconnect control rod and pipe connections, remove valve-securing bolts and remove valve. Note, for installation, the position of the pipe cover brackets and distance pieces removed with the two inboard bolts. The valve operating lever can now be removed by removing the clamping bolt, nut and washer, and sliding the lever off the valve spindle.

(5) Blank off all open connections.

#### B. Install valve

(1) Immediately prior to installation, pour a small amount of system fluid into each connection and operate the valve several times.

(2) Engage the master spline and slide the operating lever on to the valve spindle. Fit and tighten the clamping bolt, washer and nut.

NOTE : Although the valves are interchangeable, left and right, the operating levers are handed.

(3) Pre Mod.252660: open the valve by turning the valve spindle fully anti-clockwise, to the stop, and check that the groove in the face of the spindle is in line with the direction of flow.

Mod.252660: turn the on/off valve spindle fully anti-clockwise, to the stop, and check that the groove in the face of the spindle indicates that the two larger connections are open.

(4) Bolt the valve body to the mounting brackets. The two inboard bolts also secure two pipe cover brackets; distance blocks are fitted between the valve mounting brackets and the pipe cover brackets. Connect and wirelock the pipe connections.

...On/off valve - Maintenance practices continued

(5) Adjust and connect the valve controls (see Chapter 29, ON/OFF VALVE CONTROLS).

(6) Fill reservoir to the correct level (see Chapter 12, SERVICING-HYDRAULIC). If suction filter element is removed (see 1A (2) preceding) - refit filter element (see Chapter 29, SUCTION FILTER).

(7) Run engine and operate flaps and airbrakes several times over full range; check for satisfactory operation and that operating times are as detailed in Chapter 29, MAIN SYSTEM . Check for leaks and replenish reservoir as necessary after engine shut-down.

(8) Fit pipe covers.

* * *

## ON/OFF VALVE CONTROLS - MAINTENANCE PRACTICES

### 1. Adjustment/Test

A. Adjust control (Fig.201 or 202)

(1) Disconnect control rod from on/off valve.

(2) Ensure that HP fuel cock controls are correctly rigged (see Chapter 76, POWER CONTROL). Set HP fuel cock control lever to ON and insert rigging pin through hole in support plate and cable drum.

(3) Ensure that the valve operating lever is correctly engaged on the splines of the valve spindle and secured by the clamping bolt, washer and nut.

NOTE : The operating levers are handed.

(4) Pre Mod.252660: set the on/off valve to fully open, that is turn the spindle fully anti-clockwise to the stop, ensure that the groove in the face of the spindle is in line with the direction of flow.

Mod.252660: turn the on/off valve spindle fully anti-clockwise to the stop. Ensure that the groove in the face of the spindle indicates that ports B and C are open.

(5) With the on/off valve against the stop, Ref. operation (4), connect the control rod to the valve operating lever. If necessary, adjust the control rod to achieve alignment. Do not split pin attaching parts or wirelock locknuts at this stage.

NOTE : Some control rods are only adjustable at one end, the other end being covered with a shrink-on sleeve. When assembled to aircraft, rod end with sleeve must be uppermost, i.e. connected to cable drum.

(6) With operation (5) satisfied, proceed with operations (a), (b), (e) and (f). If the control rod has only one adjustable end, proceed with operations (c), (d), (e) and (f).

(a) Left side : shorten control rod by a ¼ turn (0.020 in.).

(b) Right side: lengthen control rod by a ¼ turn (0.020 in.).

(c) Left side : disconnect control rod from lever arm and screw in adjustable rod end by a ½ turn to shorten rod 0.020 in.

(d) Right side: disconnect control rod from lever arm and screw out adjustable rod end by a ½ turn to lengthen rod 0.020 in.

(e) Ensure that adjustable rod end(s) is/are in safety, tighten locknut(s) and wire lock.

(f) Check-tighten and split pin attaching parts of control rod to lever arm (bolt, washer and nut).

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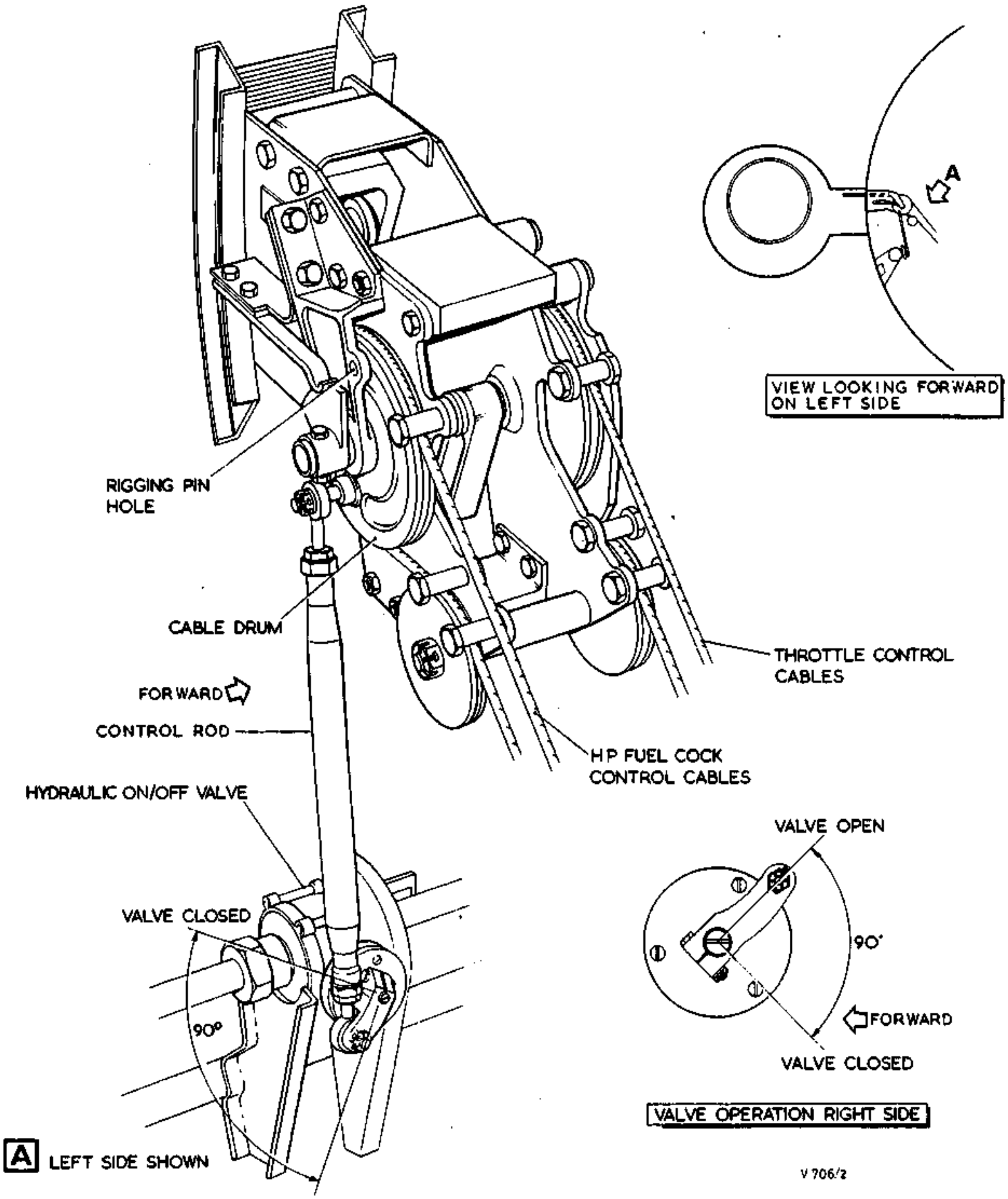

On/off valve control adjustment (Pre Mod.252660)
Fig.201

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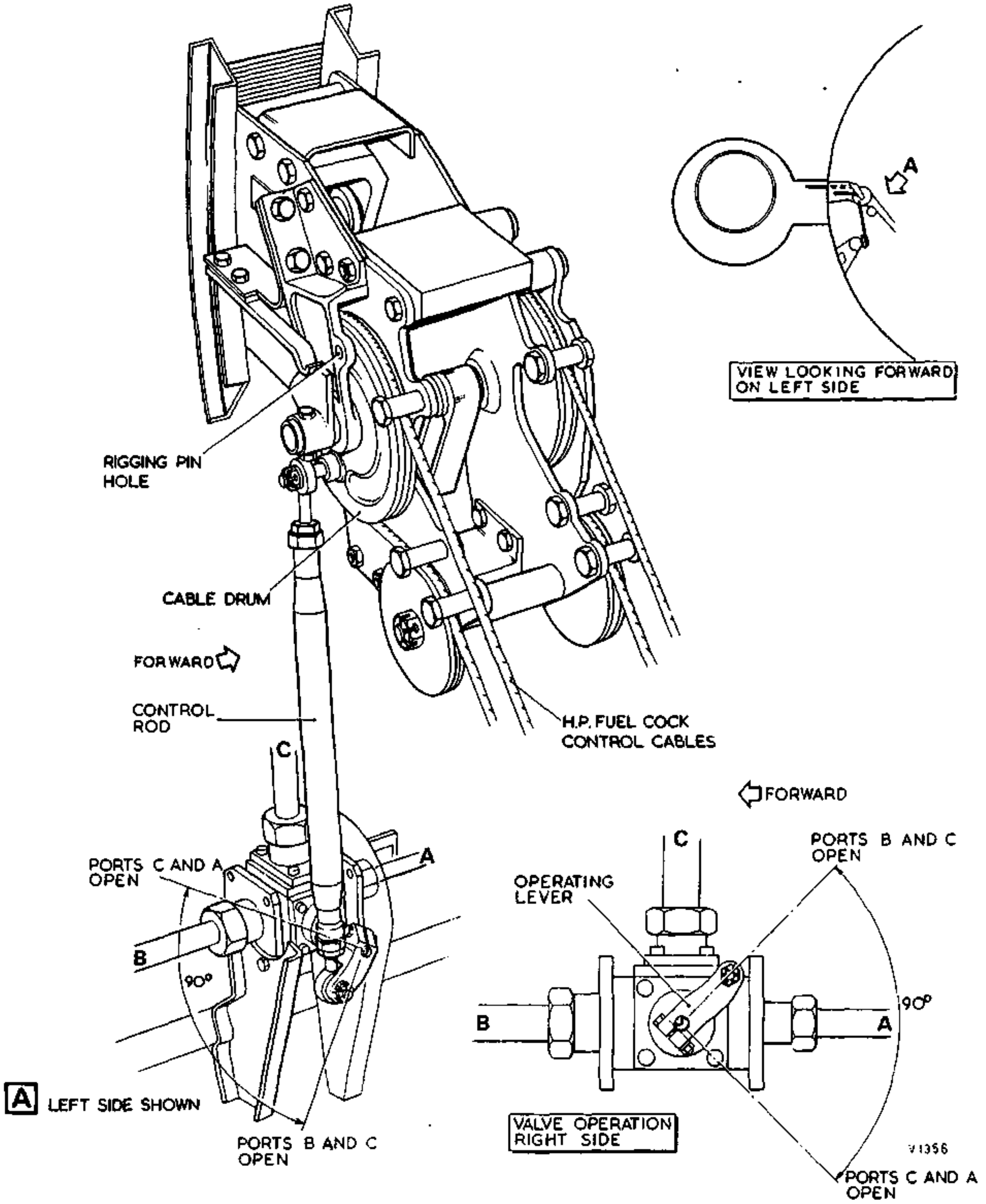

On/off valve control adjustment (Mod.252660)
Fig.202

...On/off valve controls - Maintenance practices continued

(7) Remove rigging pin inserted in operation (2).

(8) Select the HP cock control lever to off and check that the hydraulic on/off valve operates correctly :-

(a) Pre Mod.252660: valve moves clockwise to the closed position (groove in the face of the spindle at 90° to the direction of flow).

(b) Mod.252660: valve moves clockwise to close ports B and C and open ports C and A (indicated by groove in the face of the spindle).

* * *

## ENGINE-DRIVEN PUMP - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove pump

(1) Ensure that associated HP fuel cock control lever is off.

(2) Release system pressure (see Chapter 29, MAIN SYSTEM).

(3) As applicable, disconnect rigid pipe assemblies (left pump) or flexible hoses (right pump). Blank off all open connections.

(4) CAUTION : ENSURE THAT THE WEIGHT OF THE PUMP IS NOT TAKEN BY THE SHAFT.

Support pump, remove securing nuts and bracket and disengage shaft splines. Remove pump and discard gasket.

(5) If a replacement pump is to be installed, remove fittings from case drain, suction and pressure ports. Blank off all pump ports. Discard all associated O-ring seals.

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#### B. Install pump

Equipment and materials required :

| | |
|---|---|
| Torque spanner .. .. | Capable of 110 lb.in. |
| Grease .. .. | DTD 5617, Optimoly Paste PL, Molypaul GP 109, Rocol MT-LM or any grease quoted in the Garrett AiResearch Maintenance Manual. |
| Oil .. .. | Approved for engine |

(1) Check that the shaft is free to rotate by hand with no evidence of binding.

(2) If a replacement pump is to be installed, use new O-ring seals and install associated fittings in case drain, suction and pressure ports. Wire-lock fittings to pump.

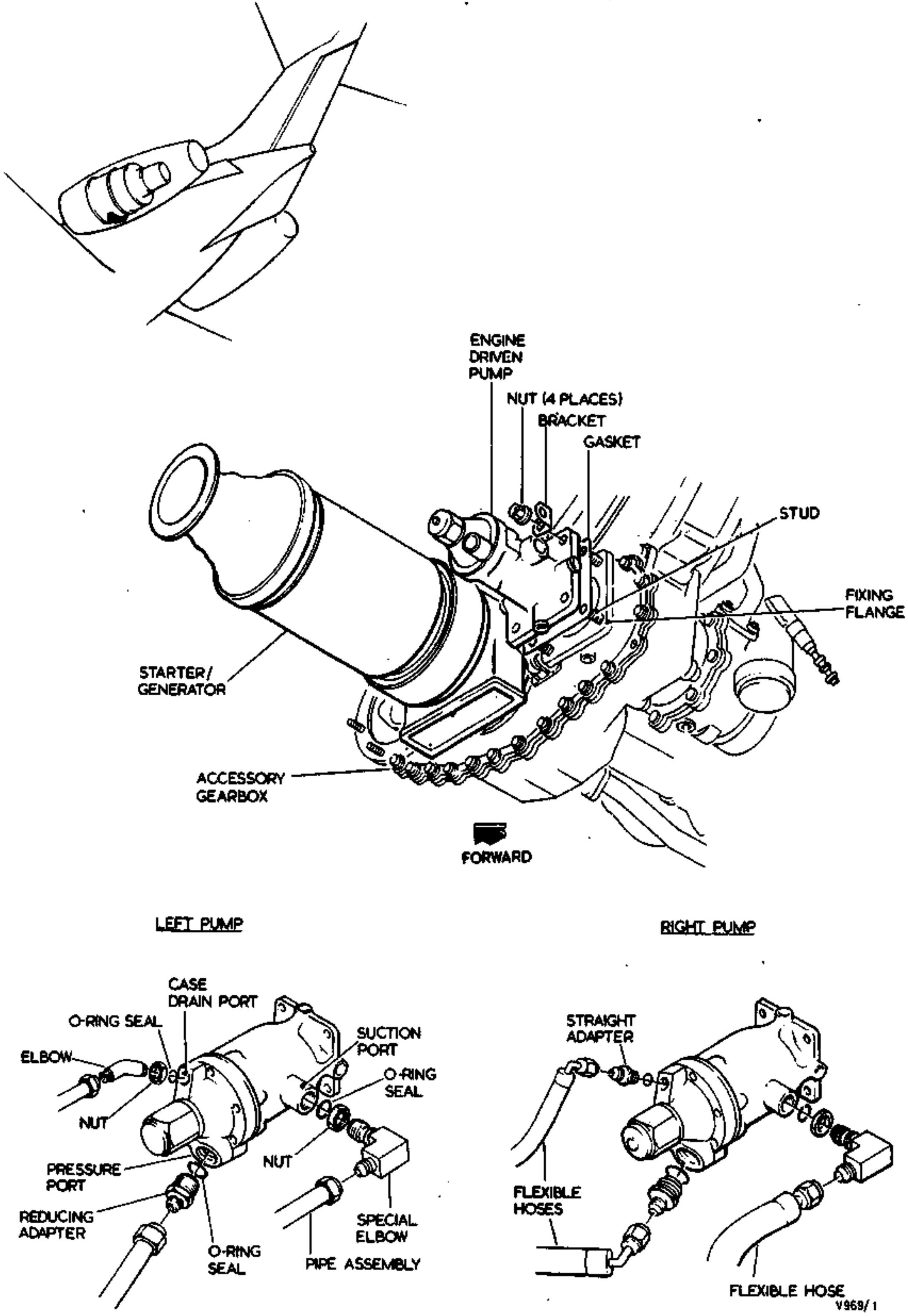
(3) Clean the pump shaft, mounting flange and mounting face.

(4) Smear the splines on the pump and accessory gearbox drive with grease. Lubricate the threads on the accessory gearbox studs with engine oil and fit new gasket to the face of the fixing flange.

(5) CAUTION : THE SPLINES ARE TO BE A GOOD SLIDING FIT; DO NOT FORCE THE PUMP INTO POSITION. DRESS ANY SLIGHTLY BRUISED SPLINES BY CAREFUL STONING BUT IF SPLINE DAMAGE IS EXTENSIVE REJECT THE PUMP.

ENSURE THAT THE WEIGHT OF THE PUMP IS NOT TAKEN BY THE SHAFT.

Align the pump shaft splines with the drive and slide the pump into position.



Engine-driven pump
Fig.201

(6) Position bracket and secure the pump in position with nuts. Tighten nuts to a torque load of 100-110 lb.in.

(7) CAUTION : AVOID ANY TWISTING OR TENSIONING OF FLEXIBLE HOSES DURING INSTALLATION. ALLOW EACH HOSE TO TAKE UP A POSITION OF RELAXED ALIGNMENT AND THEN TIGHTEN THE UNIONS EQUALLY AND IN ALTERNATE SEQUENCE; HOLD THE HOSE FIRMLY WHEN TIGHTENING THE UNION NUTS TO AVOID TWISTING THE HOSE OR TURNING THE ANGLED END FITTING OUT OF POSITION.

Remove all blanks. As applicable, connect rigid pipe assemblies (left pump) or flexible hoses (right pump) and wire-lock connections.

(8) Run the appropriate engine and operate flaps and airbrakes several times over full range; check for satisfactory operation and that operating times are as detailed in Chapter 29, MAIN SYSTEM. Check for leaks and replenish reservoir as necessary after engine shut-down.

## 2. Inspection/check

### A. Dry running of pump(s)

In the event of complete loss of fluid from the main system reservoir, resulting in the pumps running dry, take the following action :-

(1) Release hydraulic system pressure (see Chapter 29, MAIN SYSTEM).

(2) Remove pump(s) for overhaul (see Para.1.A.).

(3) Remove element from suction filter (see Chapter 29, SUCTION FILTER), check element for signs of contamination.

(4) Remove element from pressure filter (see Chapter 29, PRESSURE FILTER), check element for signs of contamination.

(5) If the suction and pressure filters are found contaminated:

  (a) Refer to Chapter 29, MAIN SYSTEM and cleanse the system of contamination.

  (b) Fit new or serviced element to suction filter (see Chapter 29, SUCTION FILTER).

  (c) Fit new or serviced element to pressure filter (see Chapter 29, PRESSURE FILTER).

  (d) Install new or serviced hydraulic pump(s) (see para.1.B.).

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...Engine-driven pump - Maintenance practices continued

B. Inspect drive coupling splines (Fig.202)

Materials required :-

| | |
|---|---|
| Lubricant .. .. .. .. | Plastilube No.3 |
| O-ring seal .. .. .. .. | Pt.No.6270-012 |

(1) Remove pump (see para.1.A.).

(2) Using a suitable tool, e.g. round-nosed pliers, squeeze coupling retainer and withdraw from pump camshaft.

(3) Remove drive coupling and discard O-ring seal.

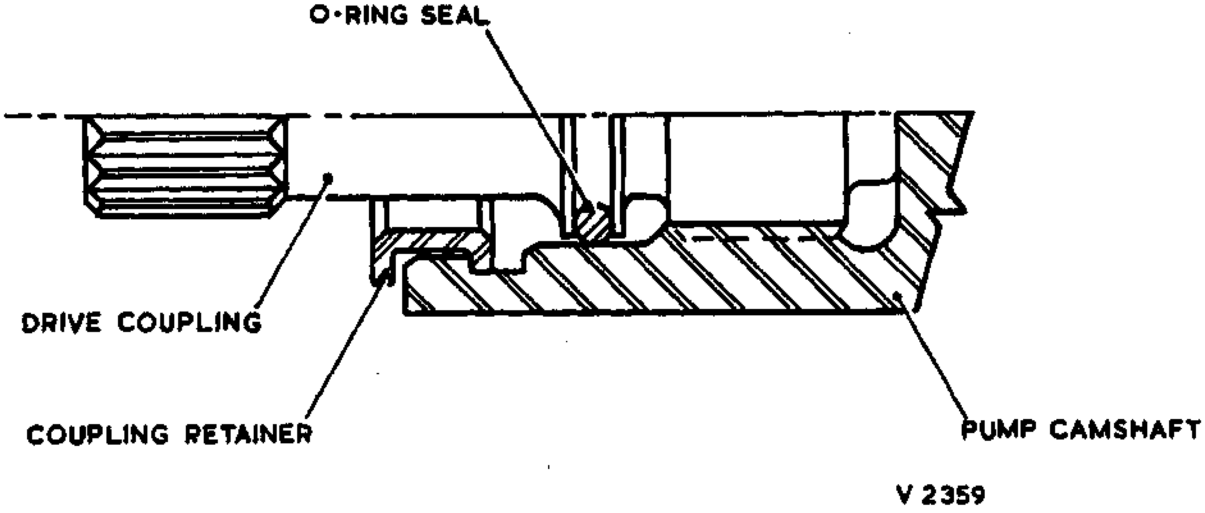
(4) Visually examine coupling and camshaft splines for wear. Worn splines necessitate pump replacement.

(5) Lubricate new O-ring seal and fit to drive coupling.

(6) Lubricate camshaft splines and related splines at pump end of coupling.

(7) Carefully insert drive coupling in pump and engage coupling retainer in camshaft to secure coupling.

(8) Install pump (see para. 1.B.).



Drive coupling installation
Fig.202

* * *

## ENGINE - DRIVEN PUMP AND RIPPLE SUPPRESSOR MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Equipment and materials required:

Hydraulic fluid to DEF. STAN. 91-48/1 Grade Superclean (MIL-H-5606E) or Normal
Grease to IL-G-21164 or, as alternative,
Aeroshell 17 or 22, Mobil grease No.28 or 29
Solvent cleaning fluid to Fed. Spec. P-D-680 Type 1 (B.S.245) Male and Female blanking caps to suit

- 7/16 - 20UNJF-3A thread (Bypass connection, pump and adapter)
- 9/16 - 18UNJF-3A thread (Pressure connection, pump and ripple suppressor outlet).
- 3/4 - 16 UNJF - 3A thread (Suction connection, adapter)
- 7/8 - 14 UNJF - 3A thread (Suction connection, pump and inlet connection of ripple suppressor).

Tray and container for oil spillage
Gasket MS9135-01
Blank for pump mounting, S8239F9S or suitable alternative Torque spanner (max. setting exceeding 110 lbf. in.)

#### B. Remove pump complete with ripple suppressor (Fig.201)

(1) Release hydraulic pressure from main system accumulators and remove nut, washer and bolt securing wiring and 'P' clip to pump bracket.

(2) Ensure that HP fuel cock for relevant engine is in 'off' position and to prevent movement from off, post notice on flight deck control.

(3) Position oil spillage tray under pump, have blanking caps to hand, disconnect pipes hoses form pump assembly and fit blanking caps to pipes/hoses and to pump assembly.

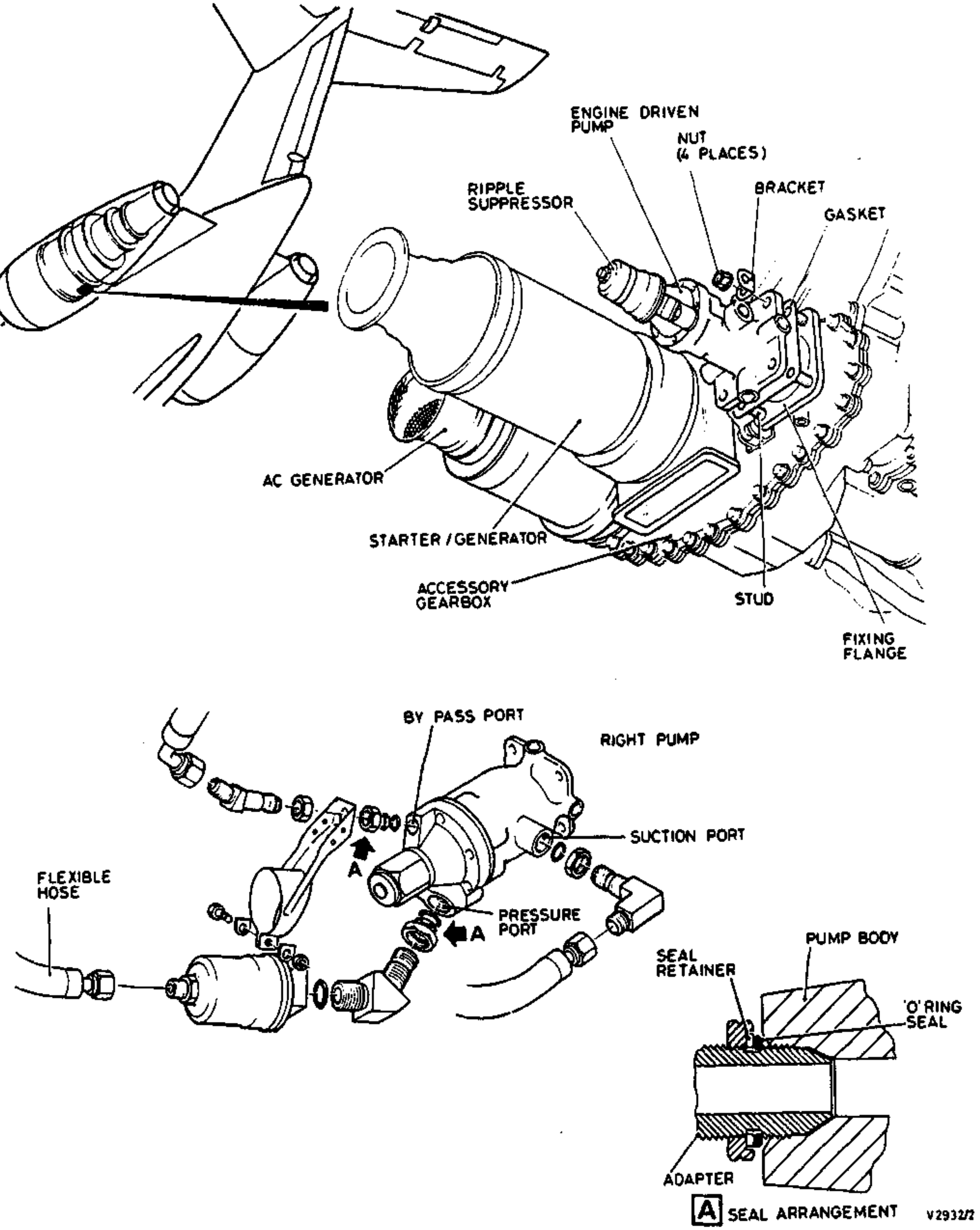
NOTE: Pre-mod 252893 connections to LH pump effected by rigid pipes. Where hoses used, observe their disposition prior to disconnection.

(4) Supporting pump assembly, hold it tight against mounting flange and remove pump securing nuts and bracket (top right hand stud).

(5) Maintaining alignment with shaft axis, withdraw pump assembly until drive disengaged.

(6) If pump assembly replacement not immediate, fit blank to pump mounting and secure with pump retaining nuts.

(7) If new or overhauled pump assembly is to be installed, transfer fittings from removed pump (see para.1.C).



Engine-driven pump and ripple suppressor
Fig.201

### C. Transfer of pump fittings and ripple suppressor

CAUTION: RETAIN AS MUCH OIL AS POSSIBLE IN PUMPS, BY FITTING A BLANK AS EACH ELBOW/ADAPTER REMOVED.

(1) Loosen suppressor bracket clamping nut and bolt.

(2) Note bypass port adapter orientation, then slacken both adapter nuts.

(3) Unscrew bypass port adapter, easing clamp up suppressor as adapter unscrews.

(4) Note suppressor orientation, then slacken pressure port adapter nut.

(5) Unscrew suppressor and adapter from pump.

(6) Note suction port elbow orientation, then slacken nut and remove elbow.

(7) Remove the 'O' rings on the elbow and two adapters and discard. Secure retaining (back-up) ring(s) if released.

(8) If suppressor/adapter assembly shows evidence of leakage, effect repair (see para. 3).

(9) Lubricate new 'O' ring for suction port elbow with hydraulic fluid, position on elbow and install elbow on new pump (see Chapter 29-00-00, page block 201).

(10) Lubricate 'O' ring seal and pressure port adapter threads with hydraulic oil, then assemble nut, seal retaining ring and 'O' ring on adapter, with retaining ring in nut counterbore. Run nut down thread so retaining ring contacts seal on the shoulder of adapter lower thread, (see Figure 201, Detail A).

(11) Maintain position of nut on thread, then install adapter thread into pump until 'O' seal begins to compress. Hold nut and turn adapter in 1½ turns plus movement to achieve correct orientation. Do not tighten adapter nut at this stage.

(12) With bypass port adapter assembled to bracket, serviceable retaining ring (if applicable) and new 'O' ring fitted (see chapter 29-00-00, page block 201), ease bracket down suppressor as adapter is screwed into pump.

NOTE: If elbow has been removed from suppressor bracket, on re-assembly, the flat faces of both nuts are to be nearest the bracket.

(13) With bypass adapter correctly aligned and securing nut tightened, check that suppressor bracket lies flat on nut.

CAUTION: TIGHTENING THE SUPPRESSOR BRACKET CLAMPING BOLT WITH THE SUPPRESSOR ADAPTER INCORRECTLY POSITIONED CAN GIVE RISE TO SIDEWAYS LOADS WHICH MAY FRACTURE THE ADAPTER.

(14) With the support bracket clamping bolt removed, use pliers to squeeze the clamp bracket flanges together. There should be no displacement of suppressor due to clamping side loads. Make any necessary (inwards) adjustment of adapter, then hold adapter and tighten adapter nut.

(15) Tighten bypass adapter suppressor bracket clamping nut.

(16) Ensure support washers correctly located and tighten suppressor bracket clamping nut/and bolt until bracket grips suppressor. Do not overtighten.

(17) Fill pumps and suppressor with hydraulic oil and refit blanks.

(18) Wirelock nuts and end cap of suppressor to its body.

D. Install pump complete with ripple suppressor

NOTE : Pre-mod.253202A pumps which are not new or fully overhauled require a drive coupling spline check (Refer to para.2.B) before proceeding. Post Mod.253202A pumps (-5 standard) proceed as follows.

WARNING : CLEANING IN FOLLOWING OPERATIONS IS EFFECTED USING MINIMUM OF SOLVENT CLEANING FLUID. THIS FLUID MAY BE TOXIC, THEREFORE OBSERVE RELEVANT SAFETY PRECAUTIONS.

(1) Remove blank (if fitted) and gasket from pump mounting. Discard gasket and clean mounting face.

(2) Fit new gasket on mounting studs.

(3) Clean accessory gearbox splined drive and check wear limit is not exceeded (see engine Light Maintenance Manual).

(4) Pack the cavity of the accessory gearbox splined drive with grease.

(5) Apply light coating of engine oil to mounting studs.

(6) Check that pump and suppressor are full of hydraulic fluid. Add fluid where necessary.

(7) Maintaining alignment of pump shaft axis and accessory gearbox drive and with bypass adapter uppermost, engage drive, align mounting holes and studs and then slide pump into full engagement, fit bracket (top right hand stud) and fit and tighten (100-110 lbf. in. torque) securing nuts.

NOTE: Drive engagement should be smooth and without undue force. Pump should be supported until nuts are tight.

CAUTION : ENSURE PIPE THREADS ARE COATED WITH HYDRAULIC OIL PRIOR TO MAKING CONNECTIONS.

(8) Position oil spillage tray under pump, remove blanks from pipes/hoses and pump connections and couple together. Fully tighten pressure and bypass connections only.

(9) Check fluid level of main system hydraulic reservoir and replenish if necessary (see SERVICING, 12-29-0).

NOTE: Initial movement of reservoir cap releases air pressure. Wait for discharge to cease before further unscrewing cap.

(10) Remove blanking plug from ground air charging connection, allow moisture to drain, connect air supply (30 p.s.i. approx) and pressurize slowly.

(11) Allow a few minutes for pressure to stabilize in hydraulic reservoir.

NOTE: Reservoir pressure controlled at 15 p.s.i. by pressure reducing valve.

(12) Remove posted notice on associated HP COCK lever.

(13) Move associated HP COCK lever to ON, slacken suction pipe/hose coupling at pump and allow fluid to flow fairly freely into a container. Check for the presence of air in the fluid and if, after 30 seconds, fluid is clear, tighten connection. If air still present, allow more fluid to flow before tightening connection.

(14) Shut off air supply to ground air charging connection.

(15) Check fluid level of main system hydraulic reservoir, replenish as necessary.

(16) Ensure reservoir cap is tight, restore air supply and wait for a few minutes for reservoir pressure to stabilize.

(17) Disconnect air supply and fit blanking cap.

(18) Move associated HP COCK lever to 'off' position.

(19) Wirelock couplings and secure wiring with 'P' clip, bolt, washer and nut to pump bracket.

(20) On first engine run after pump installation, check that, within 2 minutes of start up, relevant HYD LO PRESS annunciator (C.A.G.S/M.W.S) goes off.

(21) Check for leaks and, if necessary, remedy.

## 2. Inspection/Check

### A. Dry running of pumps

Other than at initial run after installation of a pump, or engine windmilling with HP COCK 'off', a continuous HYD LO PRESS annunciation with engine at self sustaining speed may indicate pump dry running, loss of drive etc. If dry running confirmed (main hydraulic reservoir fluid lost) or pump is suspect (very noisy) proceed as follows:

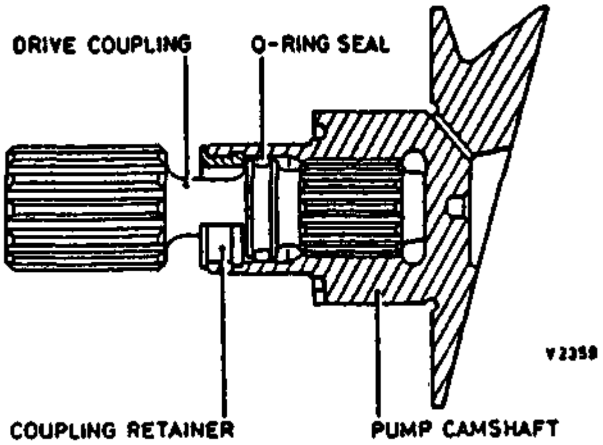
(1) Remove pump(s) for overhaul.

(2) Check the system suction filter (see 29-10-21, page block 201) and the pressure filter (see 29-10-61, page block 201) for the presence of an abnormal amount of metal particle contamination.

(3) If contamination abnormal, cleanse system (see 29-10-00, page block 201 - CLEANSE, FOLLOWING FAILURE OF E.D.P.).

(4) If contamination not abnormal, fit new suction filter element and new or clean (stainless steel, pressure filter element.

(5) Install serviceable pumps(s).



Drive coupling installation
Fig.202

### B. Pre-mod.253202A (-3 or lesser standard): Inspect drive coupling splines (Fig.202)

Materials required :-

| | | | |
|---|---|---|---|
| Solvent cleaning fluid | .. | .. | Fed spec. P-D-680 Type 1 (B.S.245) |
| Lubricant | .. | .. | Parr Inc. Plastilube No.3 |
| O-ring seal | .. | .. | 6270-012 |

(1) Remove pump (see para 1.B.)

(2) Using pliers, compress jaws of coupling retainer whilst withdrawing complete drive coupling from pump camshaft.

(3) Collect coupling retainer and discard O-ring seal.

(4) Using minimum amount of solvent cleaning fluid, degrease and clean drive coupling and camshaft splines. Check for wear and renew pump if wear evident.

**WARNING:** SOLVENT CLEANING FLUID MAY BE TOXIC AND SHOULD NOT BE INGESTED. AREA MUST BE WELL VENTILATED. FUMES SHOULD NOT BE INHALED. AVOID CONTACT WITH SKIN. OBSERVE FIRE PRECAUTIONS. DRY USING COMPRESSED AIR. PROVIDE BARRIER AGAINST CONTAMINATION OF OTHER PARTS OF PUMP.

(5) Fill splined recess of camshaft with lubricant and smear lubricant on related splines at pump end of drive coupling.

(6) Fully engage drive coupling in camshaft, then wipe away surplus lubricant and withdraw coupling.

(7) Fit new O-ring seal, locate coupling retainer (flange outward) on drive coupling, align coupling and camshaft splines and complete insertion, compressing (when necessary to effect entry into the camshaft) the jaws of the coupling retainer.

(8) Check that coupling retainer engaged in camshaft groove and install pump (see para. 1.C.).

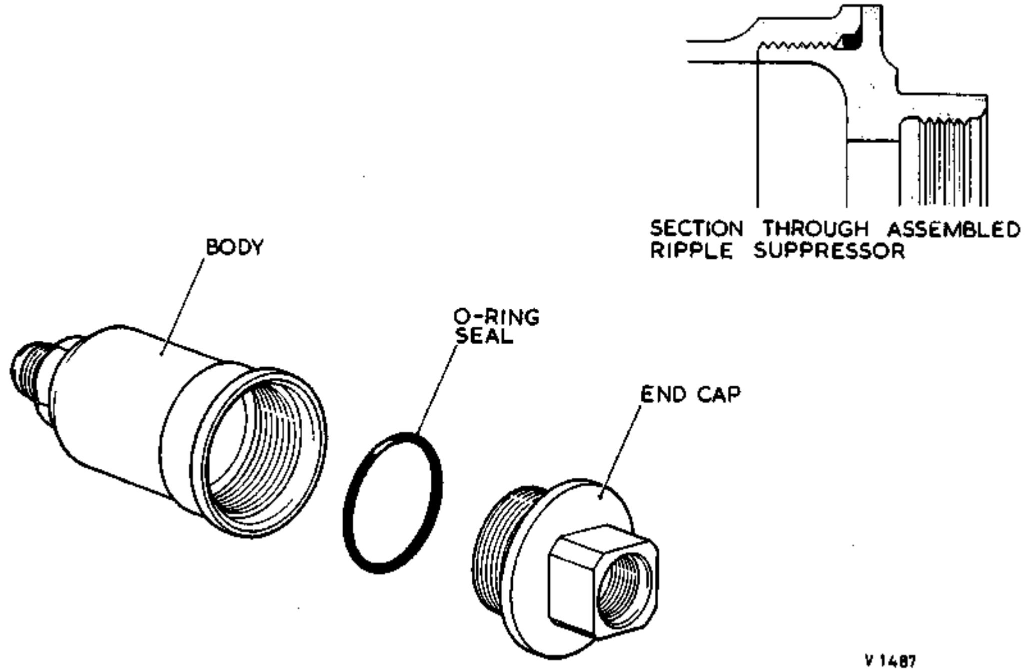
## 3. Approved repairs

### A. Renew ripple suppressor seal (fig.203)

**NOTE:** Pump must be removed from engine in order to dismantle suppressor.

Equipment and materials required:-

| | |
|---|---|
| Torque spanner | (max. setting exceeding 2,200 lbf. in. |
| Test rig | (max. hydraulic pressure exceeding 4,500 p.s.i.) |
| Hydraulic fluid | (see para. 1.A.) |
| 'O' ring | DHS 1650/E |
| 'O' ring | DHS 1655/13 |



Ripple suppressor - installation of O-ring seal
Fig.203

(1) Secure suppressor end cap and unscrew adapter.

(2) Discard 'O' ring.

(3) Secure body hexagon and unscrew end cap.

(4) Discard 'O' ring and clean components.

(5) Lubricate new 'O' ring, body and end cap threads with hydraulic fluid. Position 'O' ring in undercut of end cap.

(6) Screw end cap into body and torque tighten to 2,200 lbf. in.

(7) Lubricate new 'O' ring, end cap and adapter threads with hydraulic fluid. Position 'O' ring in undercut of adapter.

(8) Secure end cap square section and screw adapter into cap.

(9) Effect leak test (at 4,500 p.s.i.) of suppressor/adapter assembly. Rectify any faults.

(10) Blank orifices.

* * *

# ABEX ENGINE-DRIVEN HYDRAULIC PUMP - MAINTENANCE PRACTICES (Mod.252975)

## 1. Removal/Installation

### A. Equipment required:

| | |
|---|---|
| Hydraulic fluid | DEF.STAN.91-48 (MIL-H-5606E) Grade normal or Superclean |
| Grease | DEF.STAN.91-57 (MIL-G-21164) Aeroshell 17<br>or, as alternative:<br>Aeroshell 22<br>Mobil Grease No.28 or 29 |
| Solvent cleaning fluid | White Spirit (BS.245) or (Fed.Spec.P-D-680 Type 1) |
| Tray, oil spillage containing | |
| Torque spanner | Max. setting exceeding 110 lbf.in. |
| Blank, pump mounting | S8239 F9S or similar |
| Gasket, pump mounting | MS9135-01 |
| Male and female blanking caps to suit | |
| Case drain connection | 7/16 - 20 UNJF - 3A thread |
| Pressure connection | 9/16 - 18 UNJF - 3A thread |
| Suction connection | 3/4 - 16 UNJF - 3A thread |

### B. Remove pump (Fig.201)

(1) Release hydraulic pressure from main system accumulators.

(2) Ensure that HP fuel cock for relevant engine is in 'OFF' position and, to prevent movement from 'OFF', post notice on flight deck control.

(3) Position oil spillage tray under pump, have blanking caps to hand and, noting lay of hoses, disconnect each hose in turn, blanking each hose as it is released from pump and then blanking its associated port.

(4) Remove oil spillage tray.

(5) With pump held tight against mounting flange, remove pump securing nuts.

(6) Maintaining alignment with shaft axis, withdraw pump until drive is disengaged, and check that quill drive is still retained by pump.

NOTE: The quill drive is retained in the pump by a spring ring, locating in grooves in the drive and the main shaft. If quill drive should be pulled from the pump, a small coil spring will be released so, to prevent loss, arrange to collect as pump is withdrawn.

(7) If pump replacement is not immediate, fit a blank to pump mounting and secure with pump retaining nuts.

C. Remove quill drive

NOTE: The quill drive is not normally removed, but may be withdrawn for inspection of spline damage. Minor diameter splines, being more heavily loaded, are more likely to suffer wear damage and, if this should occur, it is probable that mating splines are similarly damaged, necessitating pump overhaul. Major diameter spline damage may result from improper handling of pump, whilst it is removed from engine.

CAUTION: DO NOT ALLOW TOOL TO BEAR ON SPLINES.

(1) Locate jaw of forked tool around neck of drive and, using minimum force, lever drive from pump.

D. Install quill drive

CAUTION: USE ONLY A LIGHT STEADY PRESSURE

(1) Add a light smear of hydraulic fluid to drive minor diameter splines, position drive with minor diameter spline end uppermost and insert coil spring in recess.

(2) Hold pump with mounting flange downward and, whilst pressing main shaft and drive splines into engagement, ease spring ring into groove of drive.

(3) Continue mating of drive and main shaft until detent felt as spring ring releases into shaft groove.

E. Install pump

WARNING: CLEANING IN FOLLOWING OPERATIONS IS EFFECTED USING MINIMUM OF SOLVENT CLEANING FLUID. THIS FLUID MAY BE TOXIC, THEREFORE OBSERVE RELEVANT SAFETY PRECAUTIONS.

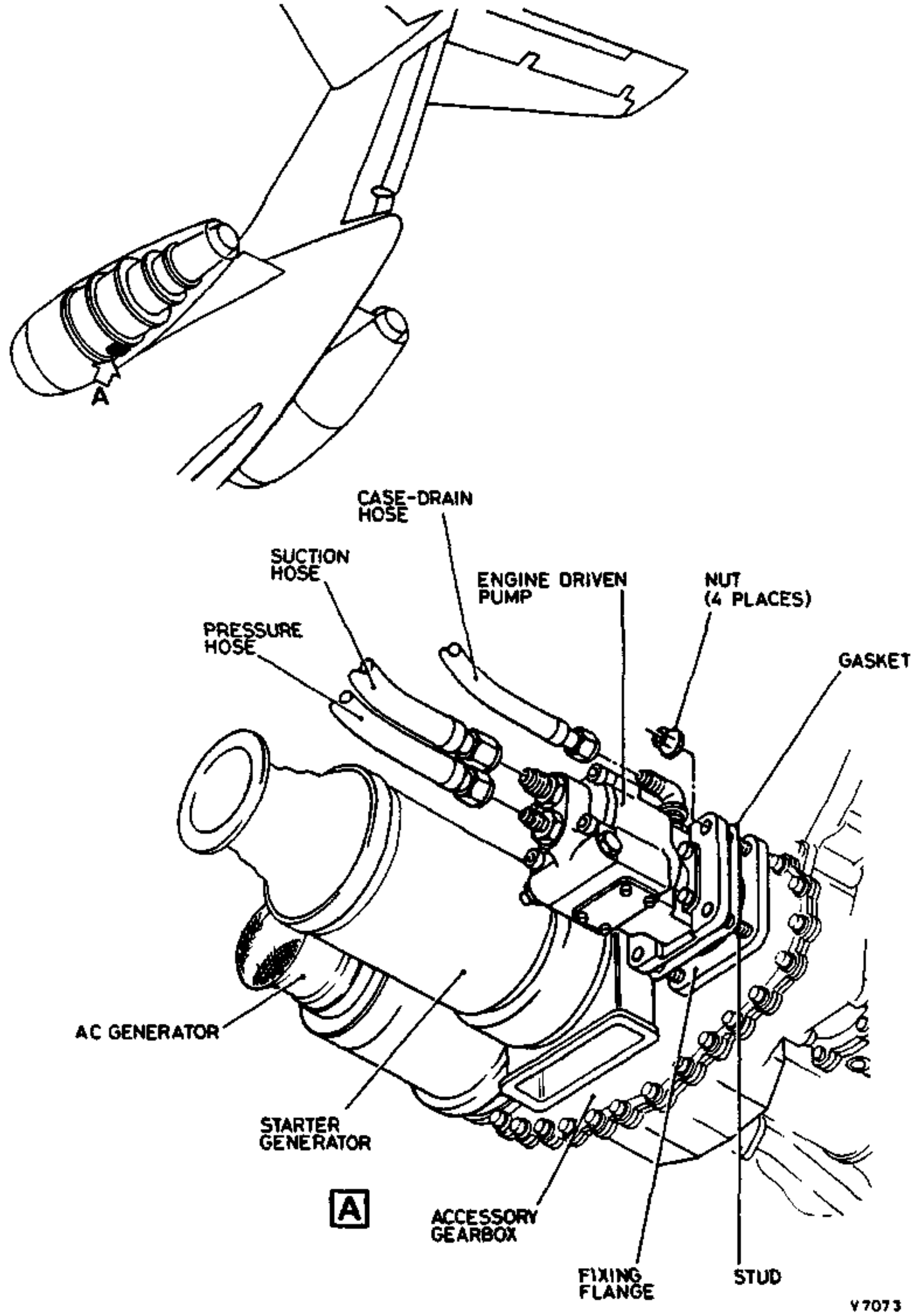
(1) From pump mounting, remove blank (if fitted) and gasket. Discard gasket and clean mounting face.

(2) Fit new gasket on mounting studs.

(3) Clean accessory gearbox splined drive and check wear limit is not exceeded (see engine Light Maintenance Manual).

(4) Pack cavity of accessory gearbox splined drive with grease.

(5) Apply light coating of engine oil to mounting studs.



Engine-driven pump installation
Fig.201

(6) Ensure pump is full of fluid.

NOTE: Check each port in turn and, if necessary, add hydraulic fluid and then refit blank. Case drain filling may be facilitated by:

(a) Fitting a short length of tubing to port
(b) Partially filling tube with hydraulic fluid
(c) Agitating pump to encourage air to vent
(d) Alternating pump position from port uppermost to drive uppermost and in each position repeating operations (b) and (c).

(7) Maintaining alignment of pump shaft axis and accessory gearbox drive and with case drain port uppermost, engage drive, align mounting holes and studs and then slide pump into full engagement. Fit and tighten (100-110 lbf.in. torque) securing nuts.

NOTE : Drive engagement should be smooth and without undue force. Pump should be supported until nuts are tight.

CAUTION : ENSURE PIPE THREADS ARE COATED WITH HYDRAULIC OIL PRIOR TO MAKING CONNECTIONS.

(8) Position oil spillage tray under pump, remove blanking cap from pump case drain port and blank from relevant hose and connect and tighten.

(9) Similarly remove blanks and connect suction and pressure hoses. Fully tighten pressure connector only.

(10) Check fluid level of main system hydraulic reservoir, and replenish if necessary (see SERVICING, 12-29-0)

NOTE : Initial movement of reservoir cap releases air pressure. Wait for discharge to cease before further unscrewing cap.

(11) Remove blanking plug from ground air charging connection, allow moisture to drain, connect air supply (30 p.s.i. approx) and pressurize slowly.

(12) Allow a few minutes for pressure to stabilize in hydraulic reservoir.

NOTE : Reservoir pressure controlled at 15 p.s.i. by pressure reducing valve.

(13) Remove posted notice on associated HP COCK lever.

(14) Bleed and prime the pump as follows :

(a) Move associated HP COCK lever to ON.

Pre-Mod.253226 aircraft

(b) Slacken suction hose coupling at pump and allow fluid to flow fairly freely. Check for the presence of air in the fluid and, if after 30 seconds fluid is clear, tighten connection. If air still present, allow more fluid to flow before tightening connection.

Post-Mod.253226 aircraft

(c) Slacken the bleed valve on the port cap and allow fluid to flow fairly freely. Check for the presence of air in the fluid and, if after 30 seconds fluid is clear, tighten bleed valve. If air still present, allow more fluid to flow before tightening bleed valve.

(15) Shut off air supply to ground air charging connection.

(16) Check fluid level of main system hydraulic reservoir, replenish as necessary (see SERVICING, 12-29-0).

(17) Ensure reservoir cap tight, restore air supply and wait for a few minutes for reservoir pressure to stabilize.

(18) Disconnect air supply and fit blanking plug.

(19) Move associated HP COCK lever to OFF position.

WARNING : THE FOLLOWING OPERATIONS RESULT IN THE MOVEMENT OF FLYING CONTROLS. ENSURE THAT THIS MOVEMENT WILL NOT RESULT IN INJURY OR DAMAGE.

(20) See POWER PLANT - ADJUSTMENT/TEST (71-00-00 page block 501) and, noting FLAPS position, select alternative extreme (UP or LAND) position, and then start relevant engine.

(21) Check that, within 2 minutes, relevant HYD LO PRESS annunciator (MWS display) goes off. If annunciator remains on, stop engine and repeat operations (10) to (12), (14) to (21).

(22) When HYD LO PRESS annunciator goes off, operate FLAPS through three complete cycles minimum, terminating with FLAPS up.

(23) Stop engine.

(24) Check for leaks and remedy if necessary.

(25) Check fluid level of main system hydraulic reservoir and replenish as necessary (see SERVICING 12-29-0).

## 2. Inspection/Check

### A. Dry running of pump(s)

Other than at initial run after installation of pump or engine windmilling with HP cock off, a HYD LO PRESS indication with engine at self sustaining speed should be interpreted as pump dry running and the following checks instituted. Failure to satisfy necessitates pump renewal.

(1) Check the pump visually for any damage, in particular overheating, indicated by signs of burning or discolouration.

(2) Check the system pressure filter (see 29-10-61 page block 201) for the presence of an abnormal amount of contamination, particularly bronze particles.

(3) When system fault corrected, run each engine separately and function the flaps through three complete cycles for each engine. Check that flap movement is smooth, that flap operating times are normal (see 29-10-00, page block 201), pump pressure is correct and pump is not making excessive noise.

Following reintroduction of aircraft into service, the system pressure filter (29-10-61) should be checked once more, approximately 10 flight hours later, for abnormal contamination.

* * *

# PRESSURE FILTER - DESCRIPTION AND OPERATION

## 1. Description

The Fairey microfilter C2125H or C2125H1 and C2125H4 (Mods.252364 and 252808, respectively) comprise a head assembly, and element and a body. The element is contained within the body which is screwed to the head assembly. An element spigot seal, installed in the top of the element, prevents unfiltered fluid from by-passing the element. A body seal, supported by a seal backing ring, prevents leakage between the head assembly and the body.

A differential pressure indicator (d.p.i.) is retained in the head assembly by four bolts. The d.p.i. is a self-contained device employing a piston, sensitive to pressure differential across the filter element, which releases a button indicating the necessity for an element change.

Pre Mod.257581 - the element is of all stainless steel construction and can be cleaned.
Mod.257581 introduces an alternative disposable element, Part No.51143 which is interchangeable with Pre Mod. element 50057.

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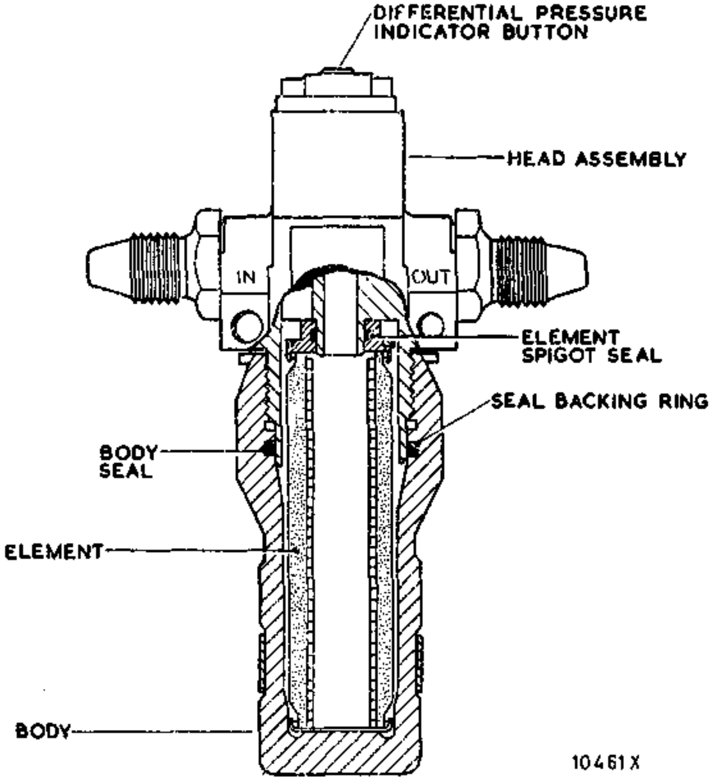
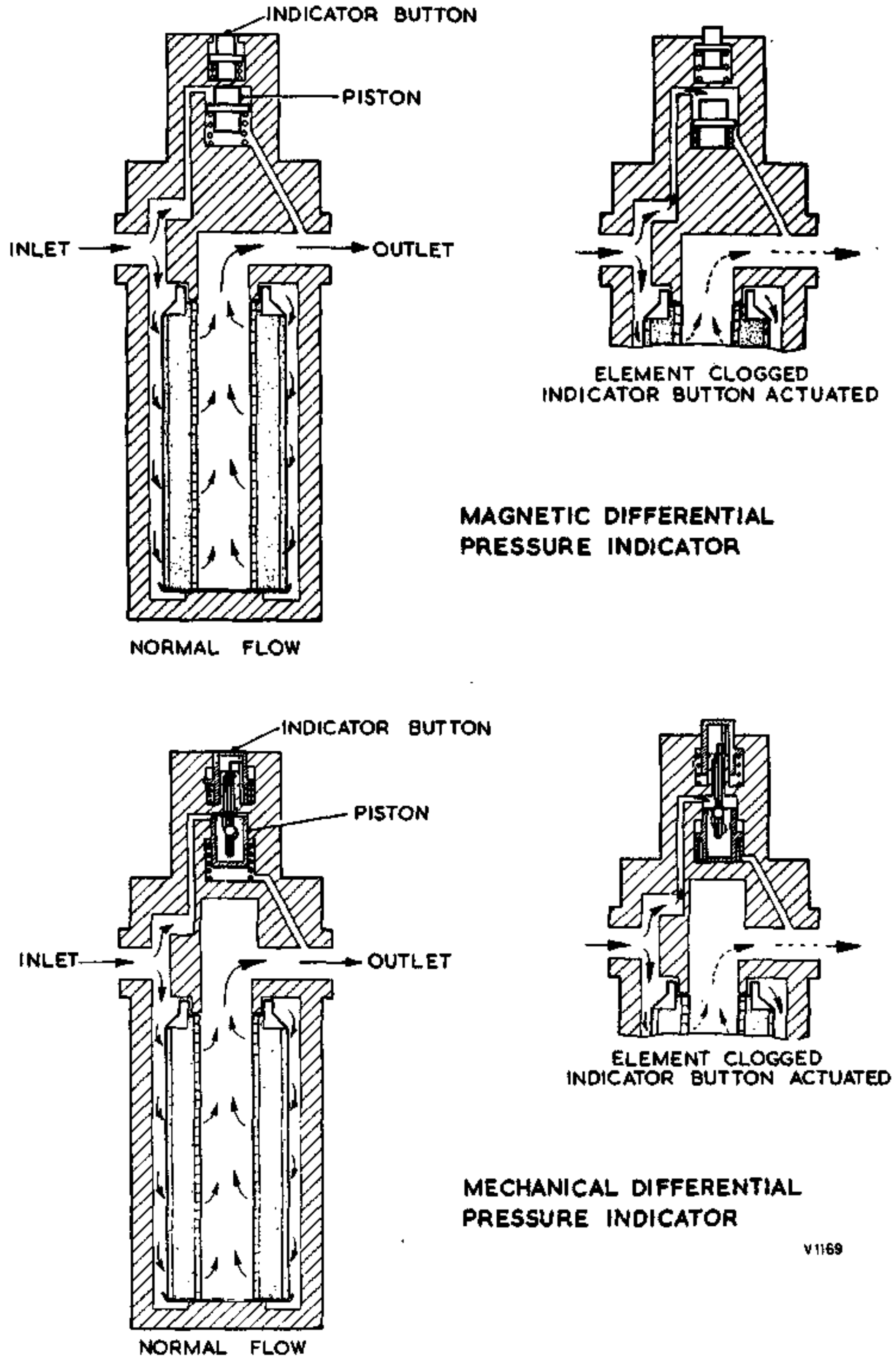


Pressure filter
Fig.1

...Pressure filter - Description and operation continued



Pressure filter - Schematic
Fig.2

...Pressure filter - Description and operation continued

## 2. Operation

Fluid enters the filter body at the inlet connection, passes through the element and up the central core to leave via the outlet connection.

During service, as the element clogs, the pressure differential across the filter increases. This increasing differential is felt across the piston of the d.p.i. and at approximately 35 lb/sq.in. (pre Mod.252808) and 55 lb/sq.in. (Mod.252808) produces linear movement of the piston against the piston spring with the following result :

A. With magnetic d.p.i. installed :

The piston, which is magnetic, moves away from the indicator button, which is also magnetic, until the attractive force is reduced sufficiently to allow the button to pop out under the influence of a spring.

B. With mechanical d.p.i. installed :

The piston movement becomes rotational and is transmitted via a torque tube to the indicator button situated on the atmosphere side of the pressure wall. The button is released under spring pressure when a tab disengages from a release gate in a bi-metal ring.

The button remains in the extended position when the pressure differential drops, indicating the necessity for element replacement. To reset the indicator button press button back into its housing using light finger pressure.

Due to the high viscosity of cold fluid, large differential pressures may be developed even when the element is clean. To prevent false indication under this condition a bi-metallic strip device is provided within the button housing, to prevent button actuation below a pre-determined fluid temperature.

## 3. Data

| | | |
|---|---|---|
| Flow rating (20 to 25 deg. C fluid temperature) ... | | 2 i.g.p.m. |
| Total pressure drop at rated flow (clean element) ... | | 8 lb/sq.in. maximum |
| Indicator button actuates ... | (pre Mod.252808) | 30 to 40 lb/sq.in |
| | (Mod.252808) | 47 to 63 lb/sq.in. pressure drop |
| Filtration ... ... ... ... ... | | C2125H - 25 micron (absolute)<br>C2125H1 and C2125H4 - 15 micron (absolute) |

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## PRESSURE FILTER - MAINTENANCE PRACTICES

### 1. Unit servicing

Equipment and materials required :-

| | | | |
|---|---|---|---|
| Seal manipulating tools | .. | .. | FHQ 100 (Fairey) |
| Hydraulic fluid | .. | .. | DTD 585 (MIL-H-5606A) |

### A. Remove pressure filter element

(1) Release system pressure (see Chapter 29, MAIN SYSTEM).

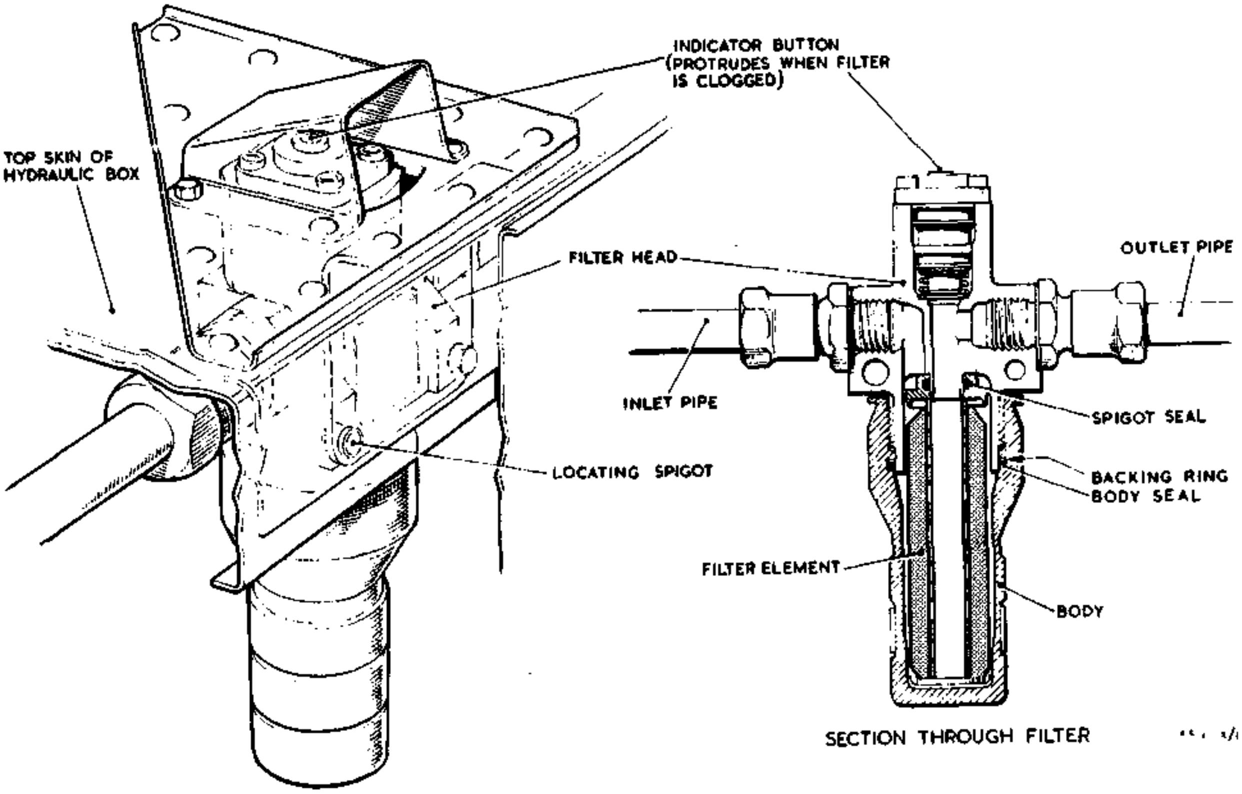
(2) Unscrew body from filter head.

(3) Drain body, remove filter element and examine for evidence of system component failure.

(4) Using seal tool, remove body seal and backing ring, and clean the body.

(5) Discard body and spigot seals.

(6) Clean filter element (see para.2.A.).



Pressure filter
Fig.201

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...Pressure filter - Maintenance practices continued

### B. Install pressure filter element

(1) Fit existing backing ring, or, if damaged, a new ring slit as shown on Fig.202.

(2) Remove all traces of french chalk from new body and spigot seals, and lubricate with hydraulic fluid.

(3) Fit new body seal, ensuring that seal is below backing ring (Fig.201).

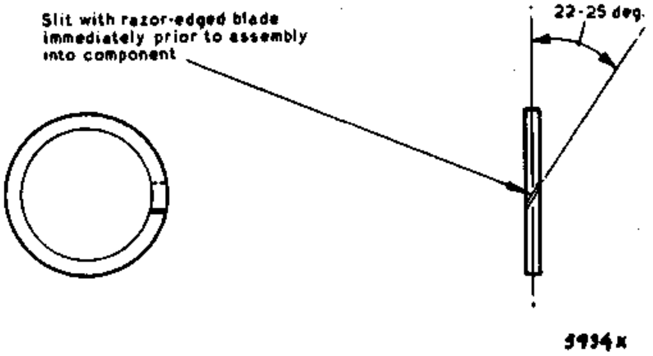
(4) Fit new spigot seal to replacement element.

(5) Insert element into filter head to engage with head spigot, and screw on body hand-tight only.

(6) Ensure that indicator button is reset to housed position.

(7) Run engine (see Chapter 71, POWER PLANT - GENERAL) and operate flaps and airbrakes several times over full range; check for satisfactory operation and that operating times are as detailed in Chapter 29, MAIN SYSTEM. Check filter for leaks.

(8) Wire-lock filter and replenish reservoir as necessary.


Slit with razor-edged blade immediately prior to assembly into component
22-25 deg.
5934x

Seal backing ring
Fig.202

## 2. Cleaning/Painting (Pre Mod.257581 only - non-disposable element)

### A. Clean filter element 50057

Materials required :

| | | |
|---|---|---|
| Degreasing fluid | .. | Trichloroethane or equivalent |
| Cleaning agents | .. | 25% Caustic soda solution (weight/volume)<br>15% Nitric acid solution (volume/volume)<br>Demineralized water |

...Pressure filter - Maintenance practices continued

WARNING : STRONG CHEMICAL REAGENTS CAN CAUSE SERIOUS INJURY IF IMPROPERLY HANDLED THEREFORE ONLY TRAINED PERSONNEL SHOULD PERFORM THE FOLLOWING OPERATIONS. OBSERVE ALL RELEVANT SAFETY PRECAUTIONS.

NOTE : 1. The element may be returned to Fairey Hydraulics Ltd for ultrasonic cleaning and testing or to any other specialized servicing organization equipped with the equipment detailed in Fairey overhaul manual Ref.: 29-10-3.

2. The following method, an alternative to ultrasonic cleaning, requires the facilities of a flow test rig to effect a pressure drop check to verify satisfactory element cleaning. This involves removal of the filter unit from the aircraft, or the use of a spare filter in which to fit the element under test.

(1) Degrease element.

(2) Immerse in boiling caustic soda solution for 3 hours.

(3) Remove and allow to drain.

(4) Thoroughly wash in boiling water for a minimum of 5 minutes.

(5) Immerse in cold nitric acid solution for 5 minutes.

(6) Remove and allow to drain.

(7) Thoroughly wash in boiling water for a minimum of 5 minutes.

(8) Final rinse in demineralized water.

(9) Oven dry at 100 - 110 deg.C. for 15 minutes.

NOTE : Control of caustic soda and nitric acid solutions should be maintained by regular chemical analysis.

(10) Carry out pressure drop test :-

(a) With filter, less element, fitted to a flow test rig and fluid (DTD 585/MIL-H-5606) temperature of 25 deg.C., apply pressure until flow is 1 i.g.p.m. Measure pressure drop across unit.

(b) Fit cleaned element and repeat as in operation (a).

(c) Subtract pressure drop in operation (a) from that in operation (b). The resultant figure gives the pressure drop across the element which should not exceed 1.4 lb/sq.in.

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## NON-RETURN VALVES (PRESSURE SUPPLY) - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove non-return valve (n.r.v.)

(1) Release system pressure (see Chapter 29, MAIN SYSTEM).

(2) Mod.252684: in the flight compartment, on panel DA/E, trip circuit breakers L HYD LO PRESS (E7) and R HYD LO PRESS (E8).

(3) Mod.252684: in the hydraulic box, disconnect the electrical connector from pressure switch installed in same junction block as n.r.v. to be removed.

(4) Remove junction block assembly complete with n.r.v. and (Mod.252684) pressure switch and snubber unit.

(5) Blank off disconnected pipelines.

(6) Remove n.r.v. from junction block.

(7) Discard O-ring seal.

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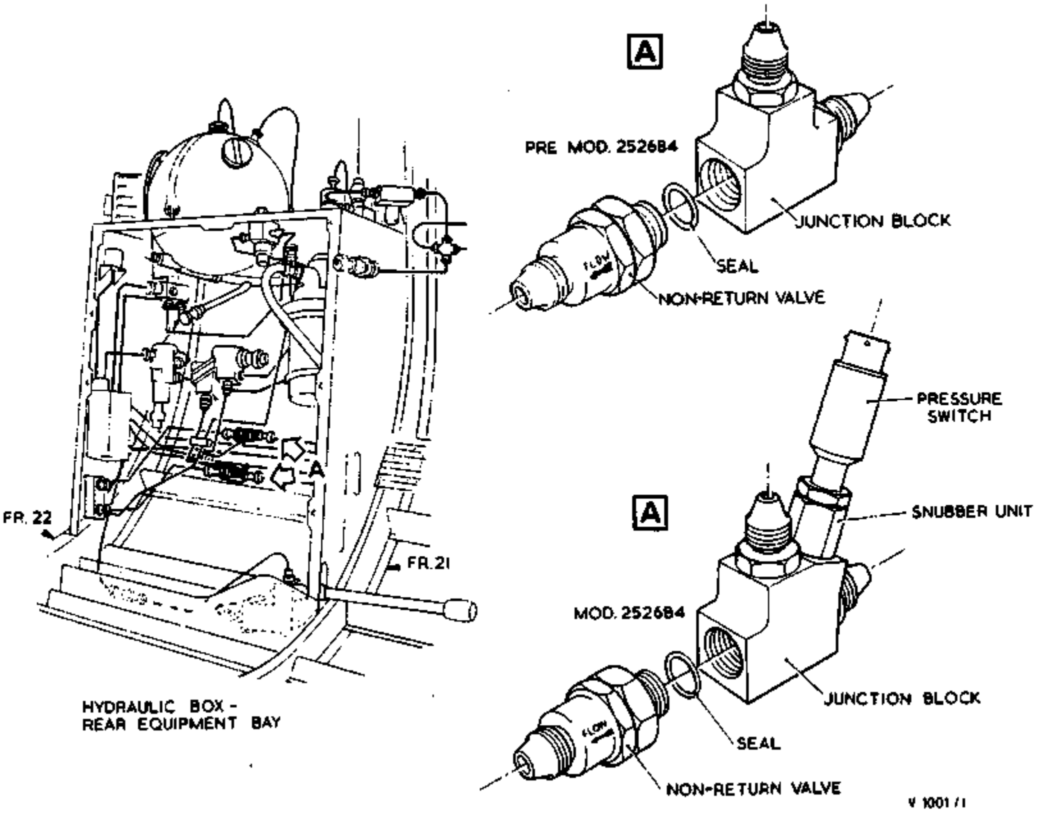

Non-return valves
Fig.201

## B. Install non-return valve (n.r.v.)

Equipment and materials required :-

| | |
|---|---|
| Torque spanner .. .. | Capable of 350 lb in. maximum |
| Hydraulic fluid .. .. | DTD585 (MIL-H-5606) |

(1) Using hydraulic fluid, lubricate and install a new O-ring seal on n.r.v.

(2) Install a serviceable n.r.v. in junction block and torque tighten to 350 lb in. maximum.

(3) Remove pipeline blanks and install junction block assembly.

(4) Wirelock pipeline connections.

(5) Mod.252684: connect electrical connector to pressure switch.

(6) Use the main system handpump to prime the system, then check for leaks.

(7) Mod.252684: reset circuit breakers (Ref. 1.A.(2)).

(8) Run the associated engine(s) (see Chapter 71, POWER PLANT - GENERAL) and operate the flaps and airbrakes several times over full range. Mod.252684: check for correct indication at HYD 1 and HYD 2 LO PRESS annunciators on MWS panel.

(9) Check for leaks and replenish reservoir as necessary after engine shutdown.

* * *

## MAIN SYSTEM ACCUMULATORS - MAINTENANCE PRACTICES

### 1. Removal/Installation

Equipment required :

| | |
|---|---|
| Inflation adapter | Turner type 772 or similar |

#### A. Remove main accumulator

(1) Release the accumulator nitrogen pressure using the inflation adapter gas release facility.

WARNING : DO NOT RELY UPON A ZERO READING ON THE ACCUMULATOR NITROGEN GAUGE AS BEING A DEFINITE INDICATION THAT GAS PRESSURE IS EXHAUSTED. AFTER RELEASING THE GAS (VIA THE CHARGING VALVE) REMOVE INFLATION ADAPTER AND THE CHARGING VALVE BEFORE DISCONNECTING THE ACCUMULATOR.

(2) Position a receptacle to collect spilt fluid.

(3) Remove hydraulic pipe connection and blank pipe and accumulator.

(4) Release both straps and remove accumulator.

#### B. Install main accumulator

Pre-installation : Remove storage blank from accumulator and drain storage fluid.

(1) Fit accumulator into mounting cradle and secure with straps.

(2) Remove blank from hydraulic pipeline and connect pipeline to union on accumulator. Tighten and wirelock.

(3) Fit inflation adapter to accumulator gas charging valve and charge with dry nitrogen in accordance with chapter 29-10-00, MAIN SYSTEM - Servicing (1.C.)

(4) Using the system handpump prime the system and check for leakage. Top-up the hydraulic reservoir.

(5) Using a hydraulic test rig (MAIN SYSTEM - Adjustment/Test (3.A.) or by running the main engines (Test 3.B.) ensure that specified pressures and operating times are achieved.

(6) Check that flight compartment indicator reads within 150lb/in$^2$ of main accumulator pressure reading at maximum operating pressure (3000lb/in$^2$ approximately).

* * *

## AUXILIARY SYSTEM - DESCRIPTION AND OPERATION

### 1. Description

The auxiliary system provides an alternative source of hydraulic power for landing gear and flap lowering. For location of system components refer to Fig.1. The hand-operated system is completely independent of the main system and is selected from a handle at the side of the radio console. Emergency lowering of the landing gear is available regardless of the setting of the landing gear selector, but the flaps must be set to the required setting before they can be lowered by the auxiliary system.

An AUX HYD LO LEVEL annunciator on the MWS panel provides warning that the auxiliary tank is not full.

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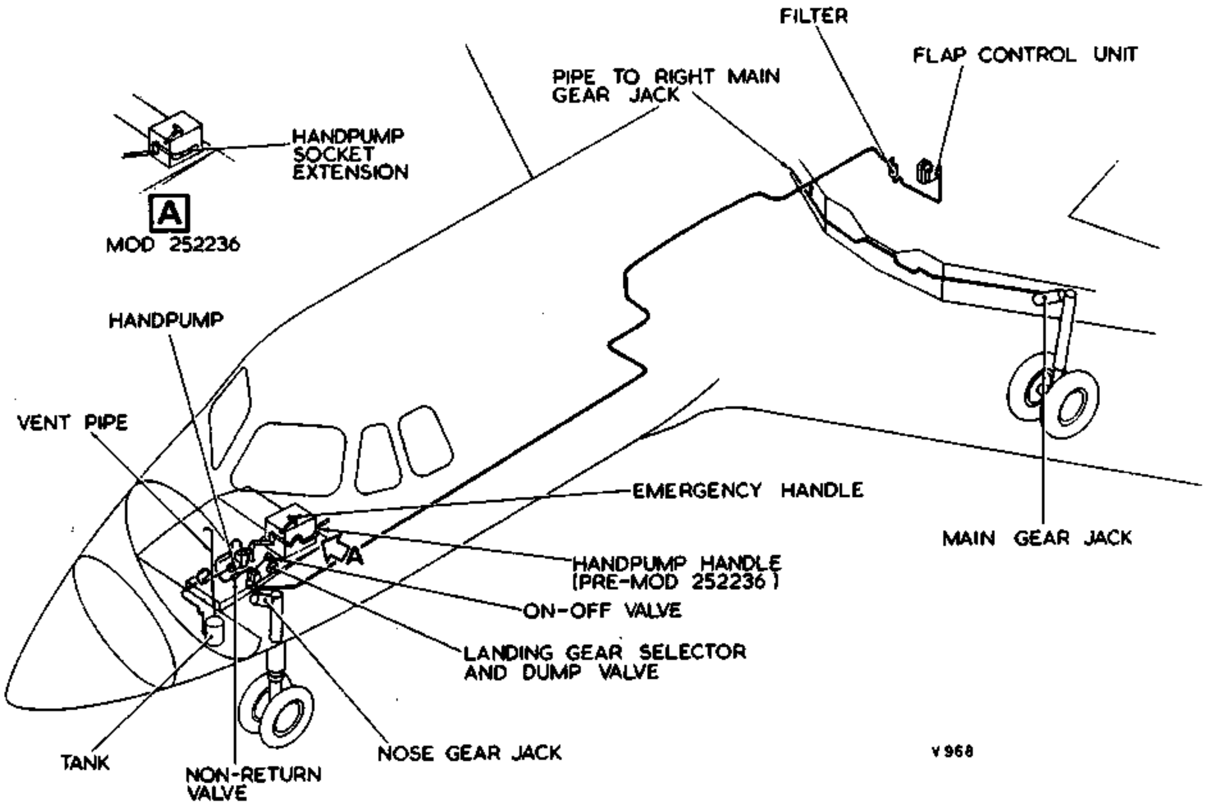
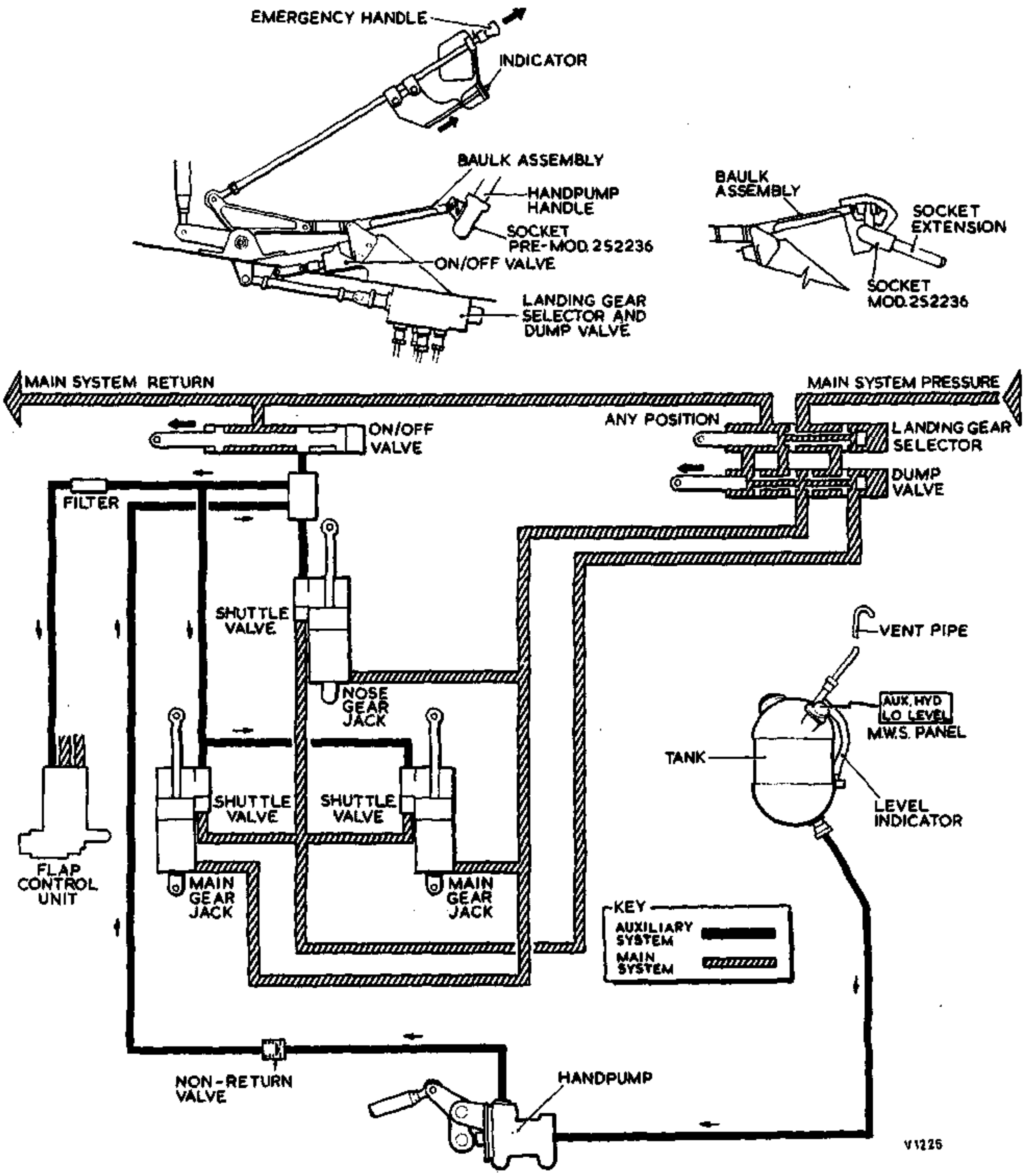


Location of auxiliary system components
Fig.1



Auxiliary system - schematic
Fig.2

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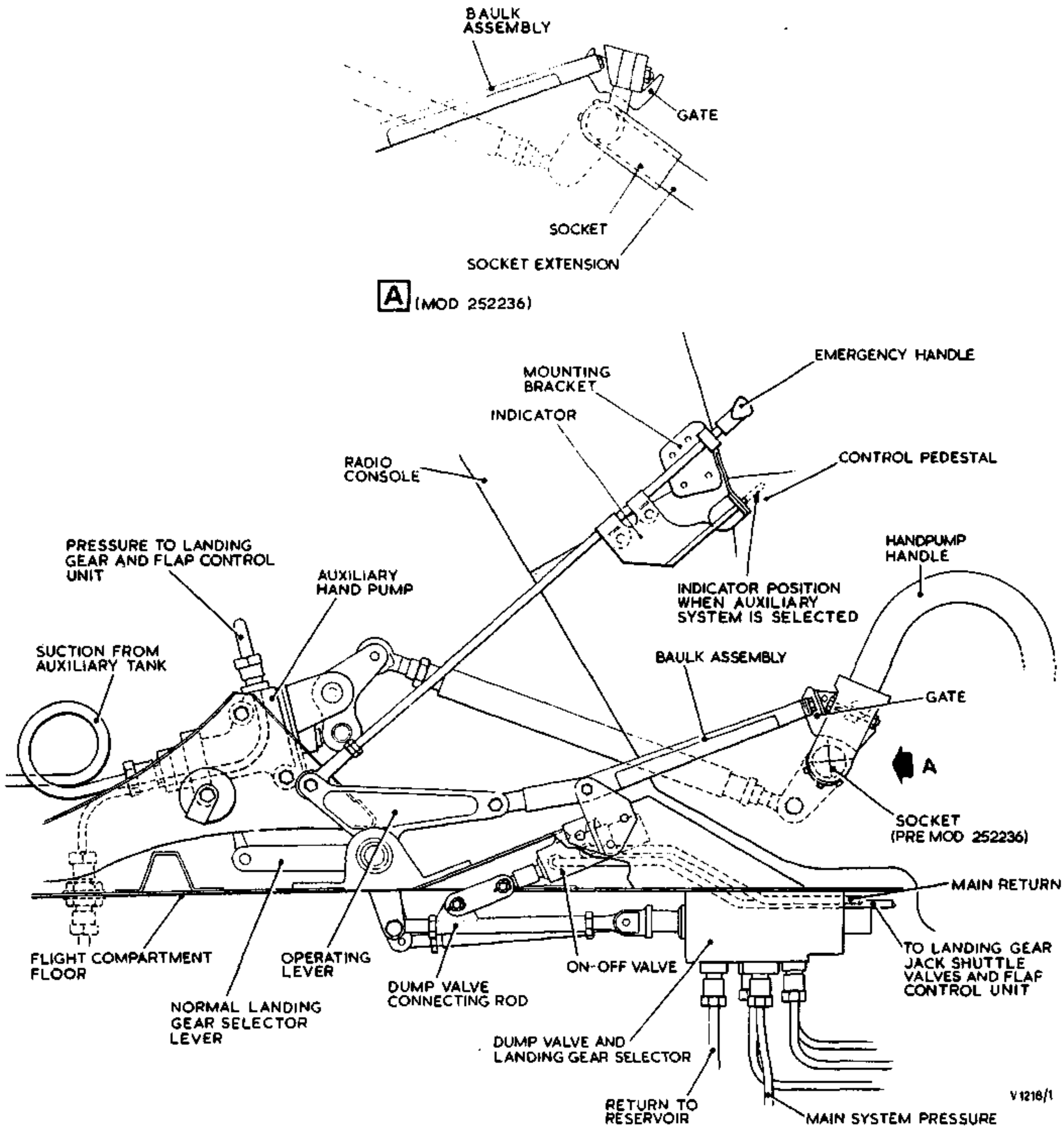


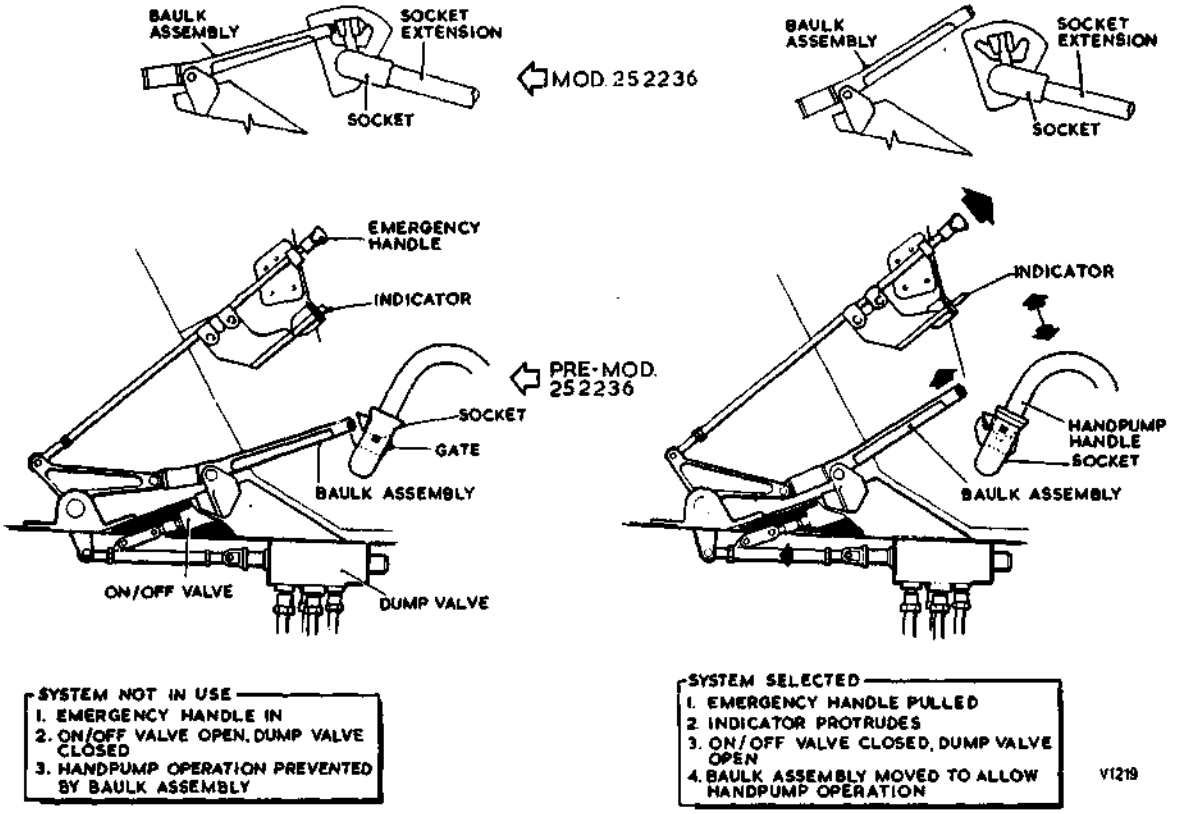
Auxiliary system controls
Fig.3

...Auxiliary system - Description and operation continued

2. Operation (Fig.2, 3 and 4)

The system is prepared for operation by an upward selection on the emergency handle (labelled PULL EMERG U/C) at the left side of the radio console; this selection :-

(a) Closes the on/off valve.
(b) Operates the dump valve to cut off any main system pressure and connect the main up and down lines of the jacks to each other and to return.
(c) Causes the indicator to protrude from the emergency handle label.
(d) Moves the baulk assembly clear of the hand pump operating socket.



Auxiliary system operation
Fig.4

The emergency handle is maintained in the selected position by the action of a spring housed in the baulk assembly. Pre Mod.252236 the handpump handle is fixed into the handpump socket; the handle has a spring-loaded break for ease of operation and stowage. With Mod.252236 embodied, the rudder gustlock bar is used as a handpump handle by inserting it into the handpump socket extension. Operation of the handpump draws fluid from the auxiliary tank and delivers it, via a non-return valve and shuttle valves, to the down side of the main and nose gear jacks and to the flap control unit.

Pre Mod.252236; following an emergency selection, the handpump handle must be returned to its stowed position and the emergency handle returned to the normal position (fully in) before the main hydraulic system can be used for landing gear or flap operation. Mod.252236; following an emergency selection, the rudder gustlock bar must be returned to its stowed position on the shroud forward of co-pilot's seat mounting, the socket extension placed in its lowest position and the emergency handle returned to the normal position (fully in) before the main hydraulic system can be used for landing gear or flap operation. With the emergency handle in the normal position, the dump valve is operated to allow normal landing gear selections, the on/off valve is opened to vent fluid from the auxiliary system side of the shuttle valves and the baulk assembly is positioned so that it prevents operation of the handpump. The spring-loaded non-return valve in the pressure line from the handpump ensures that the auxiliary system is unaffected by any return line suction when the on/off valve is open.

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## 3. Data

| | |
|---|---|
| Fluid, mineral base .. .. | DTD 585 (MIL.H.5606) |
| Tank capacity .. .. | 5 pints approx. (0.75 U.S. gal; 2.84 litres) |

* * *

## AUXILIARY SYSTEM - MAINTENANCE PRACTICES

### 1. Servicing

#### A. Action after emergency lowering of landing gear

(1) Fit ground locking pins to main and nose gears and release any main system hydraulic pressure (see Chapter 29, MAIN SYSTEM).

(2) Ensure landing gear is selected DOWN.

(3) WARNING : DO NOT RESET VALVES UNLESS GROUND LOCKING PINS ARE FITTED AND MAIN SYSTEM PRESSURE IS RELEASED.

Pre Mod.252236; lower the handpump operating handle to the stowed position and return the emergency handle to the normal (fully in) position. This action resets the emergency dump valve, opens the on/off valve and moves the baulk assembly to prevent operation of the handpump. Mod.252236; return the rudder gustlock bar to its stowed position on the shroud forward of co-pilot's seat mounting. Place the socket extension in its lowest position and return the emergency handle to the normal position (fully in). This action resets the emergency dump valve, opens the on/off valve and moves the baulk assembly to prevent operation of the handpump.

(4) Rectify the main system fault.

(5) If there has been no main system fluid loss, drain off excess fluid from the main reservoir.

(6) After use of the auxiliary system during flight, disconnect and check the reservoir pressurization air supply lines for freedom from fluid contamination. Using a suitable air supply, in the normal direction of flow, purge the lines before reconnecting.

(7) Replenish auxiliary tank (see Chapter 12, SERVICING - HYDRAULICS).

### 2. Removal/Installation

#### A. General

Removal and installation of auxiliary power system components is self evident. However, observe the following basic principles :-

(1) Take adequate precautions to avoid fluid spillage.

(2) Blank off all disconnected pipelines and couplings.

(3) After installation, replenish tank as required and functionally test the system.

#### B. Baulk assembly

Before installation of the baulk assembly ensure that associated piston and spring are correctly assembled and packed with grease specification DTD 5598 (MIL-G-23827A).

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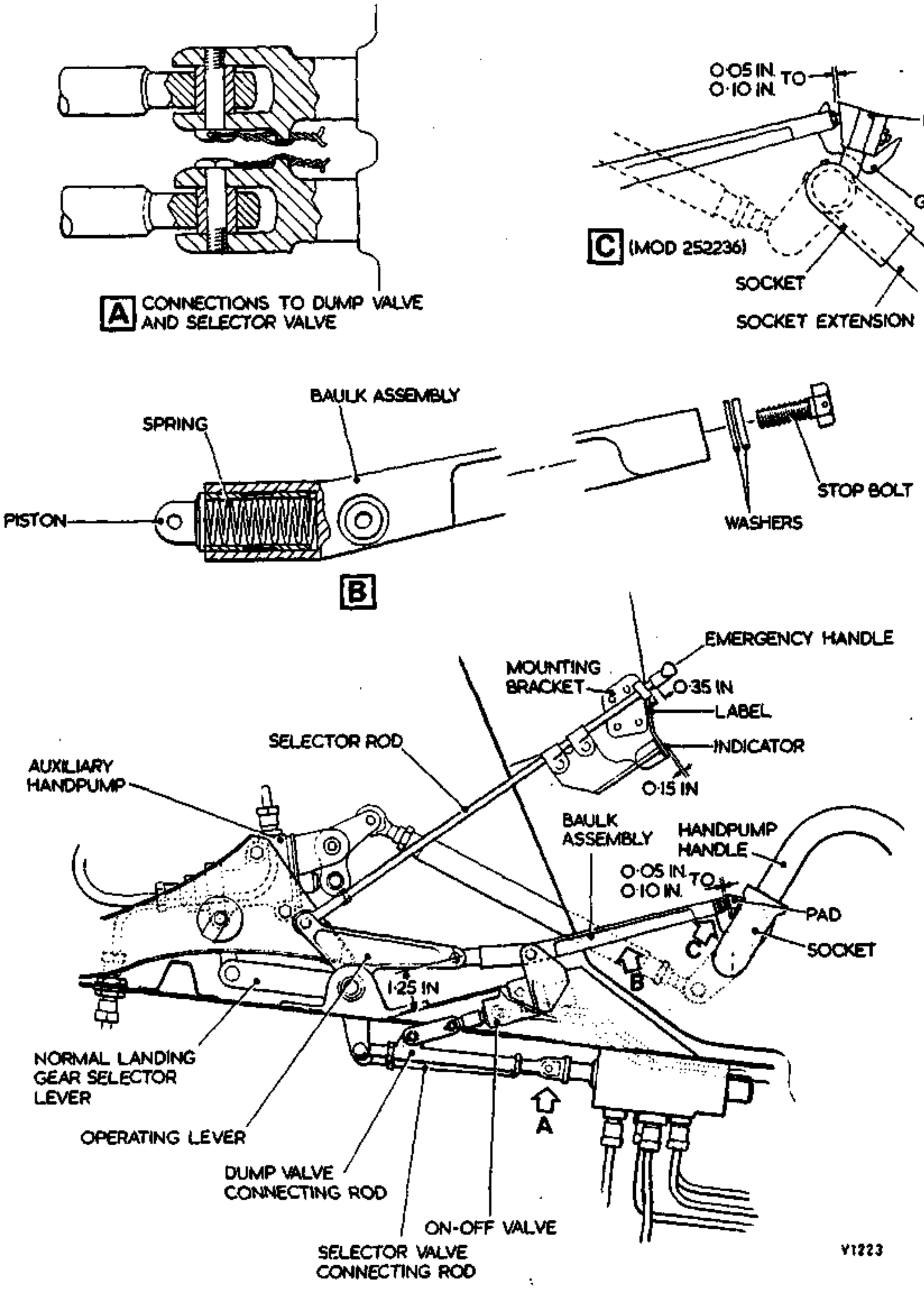

Auxiliary system - rigging controls
Fig.201

...Auxiliary system - Maintenance practices continued

3. Adjustment/Test

A. Rig system controls

(1) Fit ground locks to landing gear (see Chapter 10, PARKING AND MOORING) and release hydraulic pressure (see Chapter 29, MAIN SYSTEM).

(2) Disconnect normal landing gear selector connecting rod at lever in nose gear bay and allow it to hang down.

NOTE : Do not alter adjustment of landing gear selector connecting rod.

(3) Pull emergency handle out.

(4) CAUTION : THIS BOLT MAY BE SUBJECTED TO LOAD FROM BAULK ASSEMBLY SPRING.

Remove the bolt connecting the dump valve connecting rod to the dump valve. Push the dump valve into the valve body until it bottoms.

(5) With the dump valve connecting rod held in line with the dump valve fork-end, ease the emergency handle in to the normal position until the on/off valve bottoms.

(6) Check the alignment of the holes in the dump valve fork-end and the connecting rod eye end. Adjust as necessary on the eye end; tighten locknut after any adjustment.

(7) Pull emergency handle out.

(8) CAUTION : THE BOLTS SECURING THE SELECTOR VALVE AND DUMP VALVE TO THEIR RESPECTIVE CONNECTING RODS ARE TO BE ASSEMBLED WITH THE BOLT HEADS FACING EACH OTHER.

Pull dump valve out from valve body and connect to dump valve connecting rod, easing emergency handle in as necessary against the baulk assembly spring load to allow insertion of the bolt. Wire-lock bolt to fork-end.

(9) Push emergency handle in and ensure that the over-centre position for the forward pivot of the baulk assembly is correct by checking the dimension shown on Fig.201.

(10) CAUTION : IF ADJUSTMENT IS REQUIRED, TAKE THE BAULK ASSEMBLY SPRING LOAD ON THE EMERGENCY HANDLE WHILE REMOVING THE BOLT FROM THE CONNECTING ROD.

Adjust as necessary on the dump valve connecting rod at the lever end; tighten locknut after any adjustment.

(11) Check that, with the emergency handle in, the dimension between the handl and the mounting bracket is correct (refer to Fig.201). Adjust on the selector rod as necessary. If disturbed, check rod end for safety and lock.

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...Auxiliary system - Maintenance practices continued

(12) With emergency handle still at normal, check the protrusion of the indicator from the label (refer to Fig.201). Adjust position of indicator as necessary by slackening bolts securing indicator to selector rod, positioning indicator correctly and then tightening securing bolts.

(13) With emergency handle at normal and with the handpump handle correctly stowed (Pre Mod.252236), or with socket extension in its lowest position (Mod.252236), check that the correct clearance exists between the baulk assembly stop bolt and the pad on the socket (refer to Fig.201). Adjust as necessary by adding or removing washers from beneath the head of the baulk assembly stop bolt; up to 10 washers may be used.

(14) Reconnect the landing gear selector connecting rod disconnected in operation (2) and check landing gear selector for full and free operation. Leave selector in the DOWN position.

(15) Split pin nuts at all disturbed joints.

(16) Functionally test the auxiliary system (see para.3.B.).

B. Functionally test auxiliary system

(1) Ensure that auxiliary tank is full and replenish if necessary (see Chapter 12, SERVICING - HYDRAULIC). Check contents of main tank and ensure, by part-draining if necessary, that sufficient space is available to take the 4½ pints that will be transferred from the auxiliary system during the following operations.

NOTE : Compliance with part-draining instruction is important, to eliminate the possibility of hydraulic fluid contaminating the air conditioning system.

(2) With aircraft correctly jacked and trestled (see Chapter 7, LIFTING AND SHORING) and ground locking pins removed, and wheel brakes off, retract landing gear, using main system ground servicing handpump. Leave landing gear selector lever in the UP position.

(3) Pull emergency handle (labelled PULL EMERG U/C) out, check that the handle remains in the selected position and that the red-painted indicator protrudes from the label..

(4) Operate the auxiliary handpump and pump the landing gear down, checking that pump operation is limited by the stop on the gate. Check that both nose and main gear move to the fully locked down position.

(5) Select flaps to the LAND position. Continue pumping and check that the flaps move to the selected position.

...Auxiliary system - Maintenance practices continued

(6) WARNING : LANDING GEAR MUST BE SELECTED DOWN BEFORE VALVES ARE RESET OTHERWISE GEAR WILL RETRACT.

Select landing gear DOWN and, with handpump handle correctly stowed (Pre Mod.252236), or with socket extension at its lowest position (Mod.252236), reset dump valve and on/off valve by returning emergency handle to the normal (fully in) position against the action of the baulk assembly spring.

(7) Check that the baulk assembly prevents operation of the handpump.

(8) Pre Mod.252236; check that handpump handle is correctly stowed. Mod.252236; stow rudder gustlock bar on the shroud forward of co-pilot's seat.

(9) Replenish auxiliary tank and drain excess fluid from the main system reservoir.

(10) Retract and lower the landing gear, using the main system ground servicing handpump, to ensure that the shuttle valves are correctly positioned.

(11) Raise flaps using main system ground servicing handpump.

(12) Fit ground locking pins and lower aircraft.

* * *

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# INDICATING - DESCRIPTION AND OPERATION

## 1. General

Indicating components are located as shown on Fig.1; the instrument panel layout is typical and may vary with aircraft (see Chapter 31, AIRCRAFT INSTRUMENT LAYOUTS). The electrical supplies for main system pressure, overheat warning, tank low air pressure warning and emergency brakes accumulator pressure are taken from the PS busbars. The electrical supplies for the main system supply lines low pressure warnings and auxiliary tank low level warning are taken from PE busbar.

## 2. Main system pressure

A pressure transmitter mounted in the hydraulic box senses main system pressure, in the normal brakes supply line, which is shown on a pressure indicator on the pilots' instrument panel. The pressure indicator is contained in the same case as the brake system pressure indicators.

Two pressure switches, located in the rear equipment bay (Pre Mod.252684), one in each engine-driven pump supply line, sense main system low pressure and cause annunciators on the MWS panel labelled HYD 1 LO PRESS and HYD 2 LO PRESS to light if the relevant pressure drops below 1500 ± 50 lb/sq.in. Mod.252684 introduces snubber units, to reduce hydraulic surge effects on these pressure switches, and locates the pressure switches into the hydraulic box.

## 3. Air system pressure

A pressure switch mounted on the hydraulic box adjacent to the reservoir senses reservoir air pressure and causes an indicator labelled HYD TANK LP, also adjacent to the reservoir, to show 'white' if the air pressure drops below 10 lb/sq.in. A reset switch is situated immediately below the indicator.

## 4. Main system overheat

A temperature switch mounted on the base of the reservoir senses main system temperature and causes an annunciator on the MWS panel labelled HYD SYS O HEAT to light if the fluid temperature reaches 90 ± 3°C (194 ± 5°F).

## 5. Emergency brakes accumulator pressure

A pressure switch mounted in the hydraulic box, in the emergency brake pressure line, senses pressure in that line and causes an annunciator on the MWS panel labelled EMRG BRK LO PRESS to light if the pressure drops below 2250 lb/sq.in.

## 6. Auxiliary tank low level warning

A float switch, consisting of a reed switch in a tube over which slides a float containing a permanent magnet, is mounted in the auxiliary tank. If the fluid level drops and the float reaches the bottom of the tube the switch contacts are closed and the circuit completed to an annunciator on the MWS panel labelled AUX HYD LO LEVEL which lights to indicate that the tank is not full.

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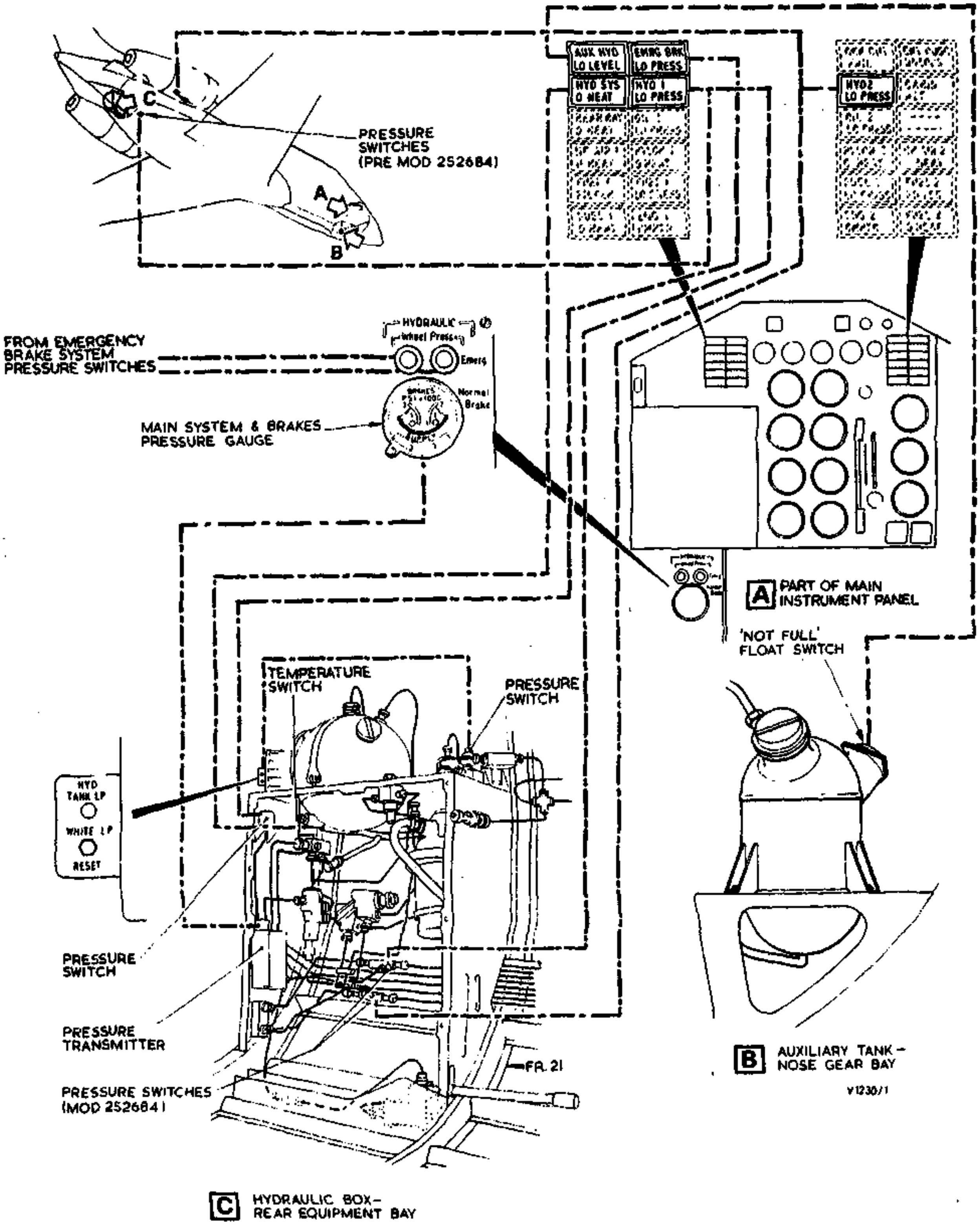
...Indicating - Description and operation continued



Location of indicating components
Fig.1

## 7. Data

Switch settings:-

| | |
|---|---|
| Main system pressure | |
| Increasing pressure | 1750 lb/sq.in. |
| Decreasing pressure | 1500 ± 50 lb/sq.in. |
| Air system pressure | |
| Increasing pressure | 11 lb/sq.in. |
| Decreasing pressure | 10 lb/sq.in. |
| Emergency brakes accumulator pressure | |
| Increasing pressure | 2450 lb/sq.in. |
| Decreasing pressure | 2250 lb/sq.in. |
| Main system overheat | |
| Increasing temperature | 90 ± 3°C (194 ± 5°F) |
| Decreasing temperature | 77°C (171°F) |

* * *

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## INDICATING - MAINTENANCE PRACTICES

### 1. Removal/Installation

General

When removing and installing indicating system components, observe the following :-

(1) Before disconnecting any electrical connections, isolate the relevant circuit.

(2) Before disconnecting any hydraulic pipelines, release system hydraulic pressure, (see Chapter 29, MAIN SYSTEM).

(3) Blank off all disconnected pipelines and components.

(4) After installation, prime the system, using the ground servicing pump, check for leaks and functionally test the system, (see Chapter 29, MAIN SYSTEM).

NOTE : Pressure switches installed upstream of non-return valves in the engine-driven pump pressure line can only be primed by use of the associated engine-driven pump or a ground test rig.

### 2. Adjustment/Test

A. Pressure indicating systems

The operation of the pressure indicating systems is tested during the hydraulic power main system hydraulic test.

B. Test auxiliary tank low level (tank not full) warning system

(1) Energize busbar PE (see Chapter 24, GENERAL).

(2) If tank is full, partially exhaust contents, using a clean syringe.

(3) Check that AUX HYD LO LEVEL annunciator, on MWS panel, lights.

(4) Replenish the tank (see Chapter 12, SERVICING - HYDRAULIC) and check that the annunciator light goes out when the tank is full, that is when the fluid level is visible in the filler neck and rises to the top of the level indicator tube.

(5) De-energize busbar PE.

* * *

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# CHAPTER

# 30

# ICE AND RAIN PROTECTION

# CHAPTER 30

# ICE AND RAIN PROTECTION

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## ICE AND RAIN PROTECTION - GENERAL

### 1. Airframe de-icing system

A fluid system is employed for de-icing the wings and horizontal and vertical stabilizers.

Nylon pipes are used throughout the system, and Simplifix couplings are used to make all pipe joints.

### 2. Pitot head de-icing system

The pitot heads, and masts by which they are attached to the fuselage, are wired for electrical heating.

### 3. Windshield de-icing system

The flight compartment forward-facing panels embody gold film elements for electrical heating.

A stand-by fluid de-icing system is also provided.

### 4. Ice detection

Formation of ice is detected by a 'rotary' ice detector unit, which completes an electrical circuit to an ICE WARN lamp on roof panel CG and to the flashers of the central attention getting system (c.a.g.s.) on the coaming panel.

A spot-lamp provides illumination of the left-hand wing leading edge, and on some aircraft also of the right-hand wing leading edge.

On some aircraft a 'hot rod' ice detector is fitted to enable the speed of ice accretion to be observed.

### 5. Engine nose cowl de-icing system

For engine nose cowl de-icing system, see Chapter 75, AIR - ENGINE ANTI-ICING.

* * *

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# AIRFRAME DE-ICING SYSTEM - DESCRIPTION, OPERATION AND DATA

## 1. Description

A TKS de-icing system is provided (Fig.1).

De-icing fluid for the system is stored in a 2.75 Imperial gallon (12.5 litres) tank; tank contents are shown on a contents gauge. The tank is vented to cabin pressure through a pipe, terminating in a vent trap to prevent entry of foreign matter. For flights of long duration provision can be made for the storage of a 1.0 Imperial gallon (4.55 litres) container of de-icing fluid in the main luggage compartment.

The fluid pump is a 28-volt d.c. motor-driven unit. Flow from the pump through a micro-filter is controlled by a check valve (Fig.2), which closes when then pump is inoperative, to prevent delivery of fluid due to cabin pressure. A head compensating valve corrects the system pressure levels for head variation between the wing, vertical and horizontal stabilizers. Non-return valves, located on the vertical stabilizer front spar (Fig.1), prevent back flow when the system is inoperative. A by-pass bleed orifice, at the root-end of each wing feed gallery pipe, compensates the fluid flow at very low ambient temperature conditions, to the inner distributor panels.

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## 2. Operation

De-icing fluid is drawn from the tank by the pump, and fed through the micro-filter and the check valve, which opens when delivery pressure reaches 10 lb/sq.in. The head compensating valve, which is set at approximately 5 1/2 lb/sq.in., ensures equal fluid pressure at the wings and vertical and horizontal stabilizers.

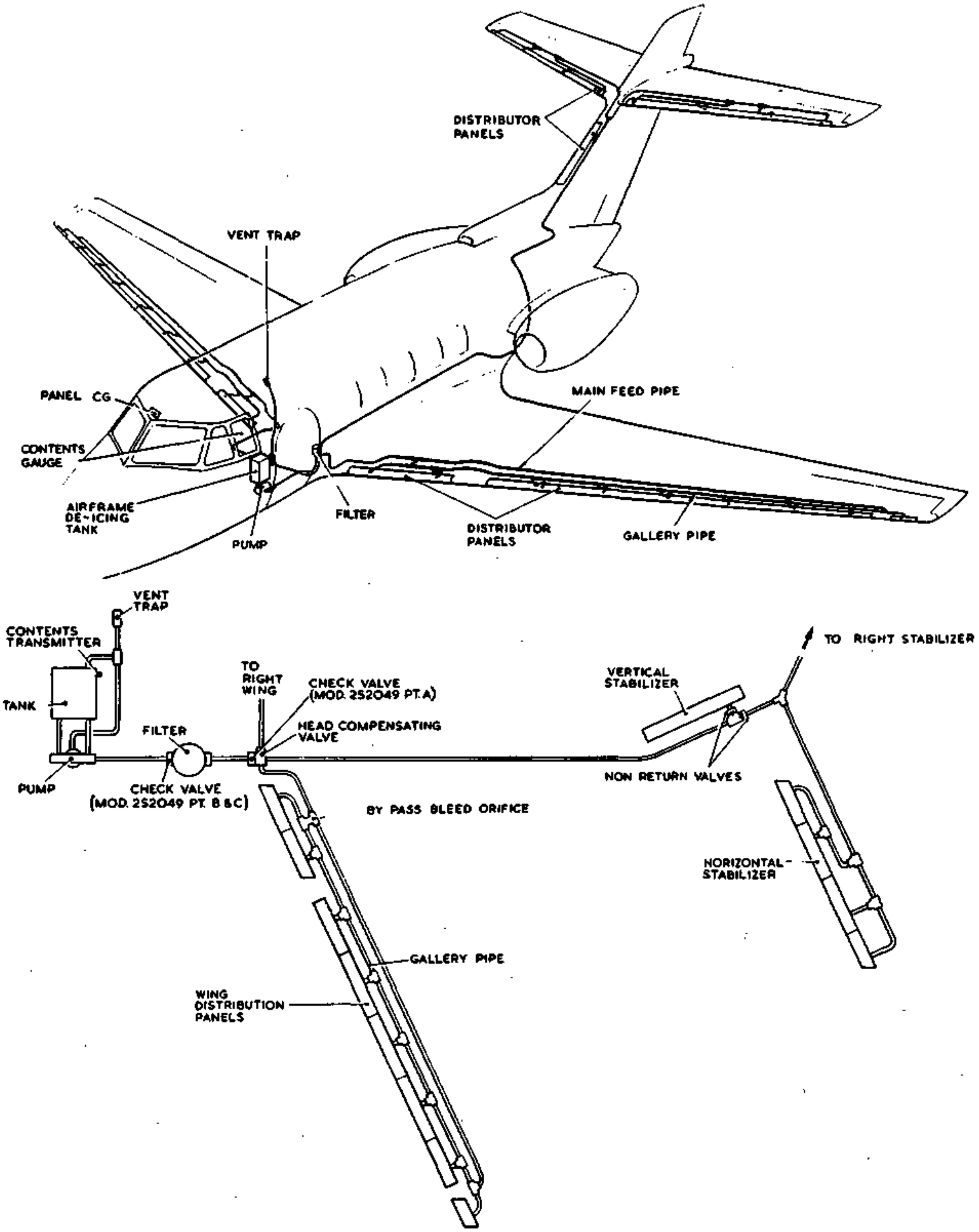
At each distributor, de-icing fluid passes through a metering tube into a cavity, and then through a micro-porous plastic sheet to a micro-porous stainless steel outer skin. As fluid escapes to atmosphere, it is directed, by the airflow, rearward over the aerofoil.

The pump is controlled by either a PRIME time-switch or WING & TAIL on/off switch, both located on the ICE PROTECTION section of roof panel CG. The system operates continuously when the WING & TAIL switch is at ON. The time-switch provides for routine priming of the system; when set to PRIME it connects an electrical supply to the pump for a maximum period of 8 minutes (pre Mod.252681) or 10 minutes (Mod.252681).

## 3. Data

| | |
|---|---|
| De-icing fluid specification .. .. | TKS R328 or fluid to specification DTD 406B or TKS P208 |

See Fig.1 and 2 following



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Airframe de-icing system
Fig.1

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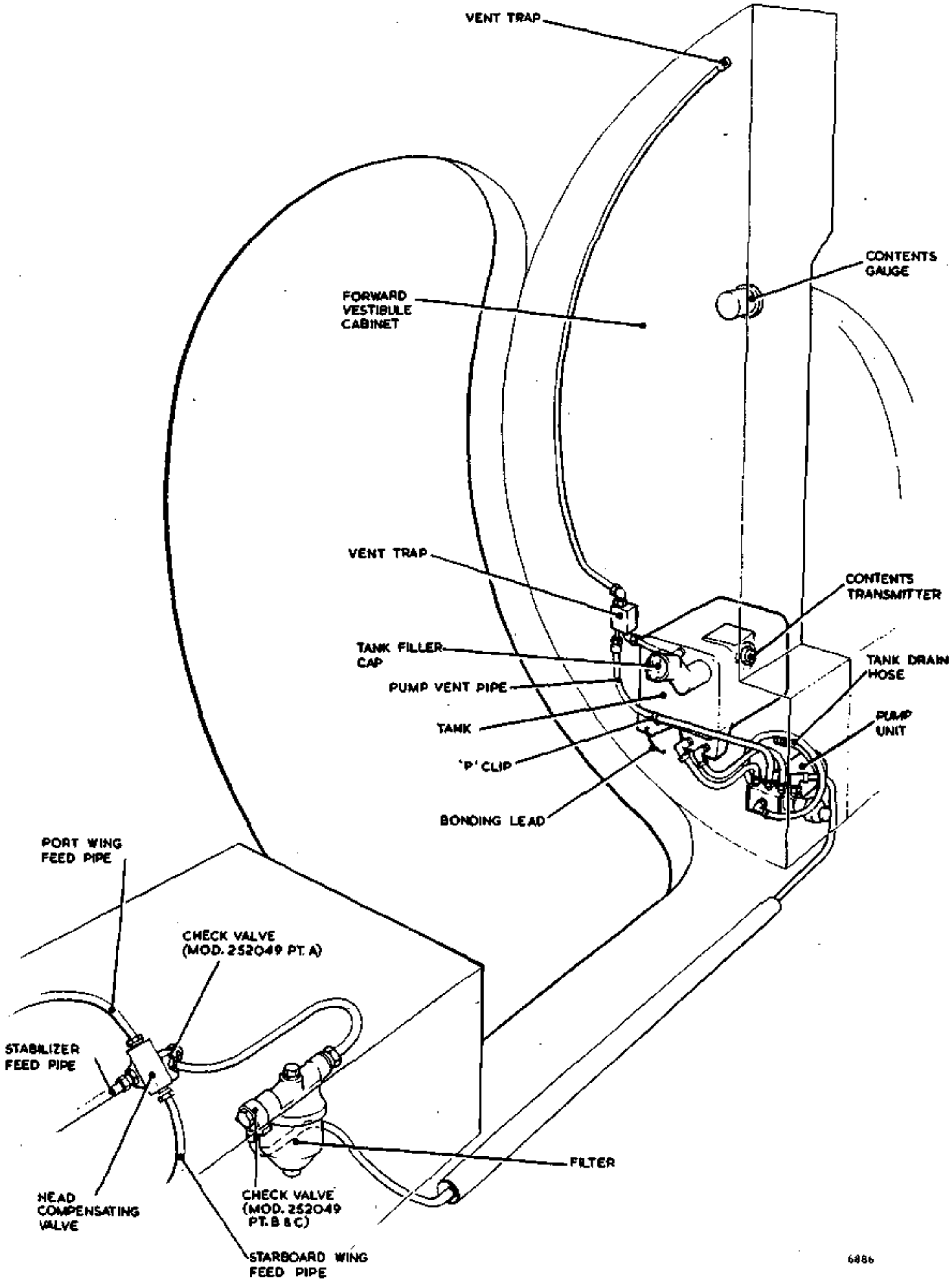

De-icing equipment installation in fuselage
Fig.2

* * *

## AIRFRAME DE-ICING SYSTEM - TROUBLE SHOOTING

| Fault | Possible cause | Remedy |
|---|---|---|
| No flow at any distributor | Fluid tank empty | Fill tank with fluid |
| | Pump not operating | Check electrical circuit to pump. If failure of motor or pump, fit new unit |
| | Pump filter blocked | Remove head plate, clean filter |
| | Check-valve sticking | Fit new valve |
| | Pipeline to filter blocked | Remove obstruction. |
| | Micro-filter blocked | Fit new element |
| No flow, or reduced flow at distributors on one surface | Head compensating valve sticking or blocked | Fit new valve |
| | Pipeline couplings loose | Tighten couplings |
| No flow at one distributor | Metering tube blocked | Remove metering tube and clear with compressed air, or renew metering tube. |
| | Feed pipe blocked, or couplings loose | Remove obstruction or tighten couplings |
| | Distributor blocked externally | Clean surface of distributor with soft brush and warm water |
| | Distributor blocked internally | Renew distributor |
| | Distributor damaged | Renew distributor |
| Excessive fluid consumption | Leaks from pump seals | Fit new pump |
| | Pump incorrectly calibrated | Fit new pump |
| | Internal pump fault, causing excessive delivery | Fit new pump |

...Airframe de-icing system - Trouble shooting continued

| Fault | Possible cause | Remedy |
|---|---|---|
| No flow at distributors after partial disassembly or after running fluid tank dry etc. | Air trapped in system | NOTE: This defect is most likely to arise if the porous membranes within panels have remained wet after the last operation of the system, thus restricting the passage of air to atmosphere. The aim of the following procedure is to dry the porous membranes and obviate the restriction.<br>1. Disconnect the main fluid pipeline to the complete sub-system in which the affected panel/s are located, i.e. at a wing root, or at an accessible position in the pipe run to the vertical/horizontal stabilizer sub-system.<br>2. Connect a clean air supply to the disconnected pipe and pass air at 40 p.s.i. (max.) into the sub-system until all evidence of fluid foaming has ceased at all the sub-system panels.<br>3. Re-assemble the disconnected pipe connection and repeat the test of the complete airframe de-icing system. |

## AIRFRAME DE-ICING SYSTEM - MAINTENANCE PRACTICES

1. Adjustment/Test

A. Prime and functionally test airframe de-icing system

CAUTION : DRY-RUNNING OF THE PUMP IS NOT PERMISSIBLE. DO NOT RUN PUMP WITH TANK EMPTY.

(1) Energize relevant busbar (see Chapter 24 GENERAL).

(2) Ensure that de-icing tank is not less than half full.

(3) Switch on de-icing pump.

(4) Check that fluid commences to flow from the major portion of each distributor.

NOTE : 1. The time taken for fluid to flow from the distributors, and its distribution pattern, depends on ambient temperature and related fluid viscosity.

2. At ambient temperatures below or near freezing point, when fluid viscosity is high, the time taken to achieve operation (4) above on initial priming may be as long as 20 minutes.

3. At higher temperatures with consequent lower fluid viscosity, flow from the distributors should be achieved in a few minutes although may only be in evidence initially along the inner portions of the wing distributors due to dihedral effect. However, unless there is local blockage of a distributor, the spanwise flow pattern in flight should appear uniform.

4. Prevent as far as possible de-icing fluid running back along the wing and horizontal stabilizer undersurfaces.

(5) Switch off de-icing pump.

(6) De-energize relevant busbar.

(7) Fill de-icing fluid storage tank (see Chapter 12, ICE AND RAIN PROTECTION).

* * *

## PIPE COUPLINGS - MAINTENANCE PRACTICES

### 1. Unit servicing

Equipment and Materials required :

| | |
|---|---|
| Clenching tool .. .. | Part No. TKS T300-112A (for 3/16 in. o/d tube) |
| Clenching tool .. .. | Part No. TKS T300-120A (for 5/16 in. o/d tube) |
| De-icing fluid .. .. | Specification DTD 406B or TKS P.208 |

### A. Make Simplifix coupling (Fig.201)

NOTE : Should it become necessary to disconnect a coupling, use a new sealing ring on re-assembly. It will not be necessary to perform clenching operations (1) to (7) unless a tube is to be renewed and a new olive fitted.

(1) Ensure nylon tube end is square: assemble nut and olive to tube.

(2) On the appropriate clenching tool, ensure that mandrel is screwed fully home; smear tapered end of mandrel with de-icing fluid.

(3) Press end of nylon tube fully home into clenching tool (see Fig.202).

(4) Slide olive into clenching tool, engage nut with clenching tool; screw nut up finger tight.

(5) CAUTION : THE OLIVE MUST BE FULLY CLENCHED AS A SEPARATE OPERATION AND BEFORE INTRODUCTION OF THE SEALING RING. ANY ATTEMPT TO CLENCH THE OLIVE WITH THE SEALING RING IN POSITION WILL DESTROY THE RING AND PREVENT THE OLIVE CORRECTLY LOCKING ON THE TUBE.

Stabilize clenching tool and, using a suitable pipe ring spanner, rotate tube nut from finger tight condition to approximately 315 degrees 5¼ flats of the nut) to clench the olive as shown on Fig.202.

NOTE : 1. As a guide, it will be found that the tightening torque is relatively constant initially but then rises rapidly. A correctly clenched olive should be obtained if tightening is terminated just after the point where the rapid torque increase commences.

2. Rotation of the tubing, olive and mandrel may occur during clenching; this is permissible.

(6) Carefully unscrew and remove mandrel from clenching tool.

(7) Unscrew nut and withdraw nylon tube, complete with olive and nut, from the clenching tool.

(8) Examine the assembled olive and check that it conforms with the correct appearance shown on Fig.203. Check that the limits of tubing length extending beyond the clenched end of the olive is maintained.

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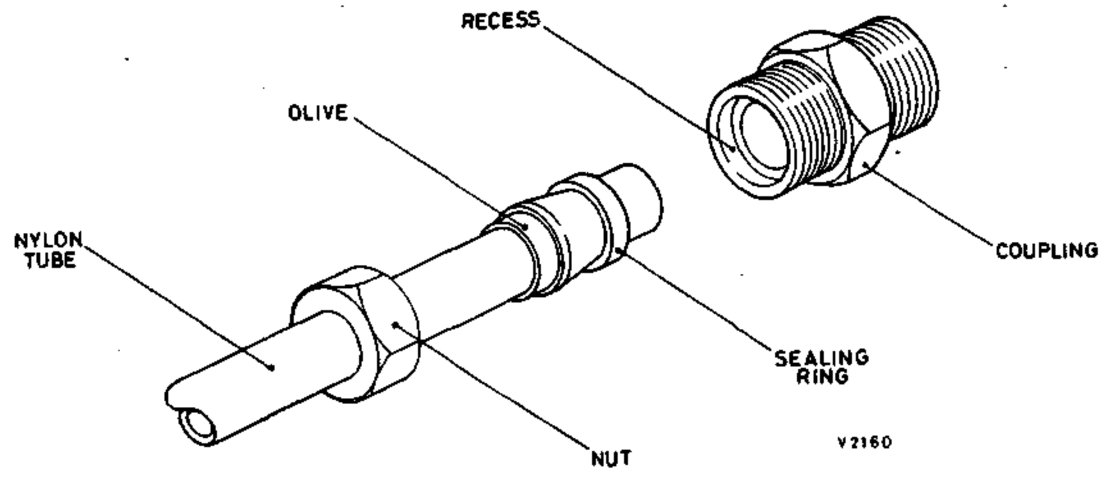
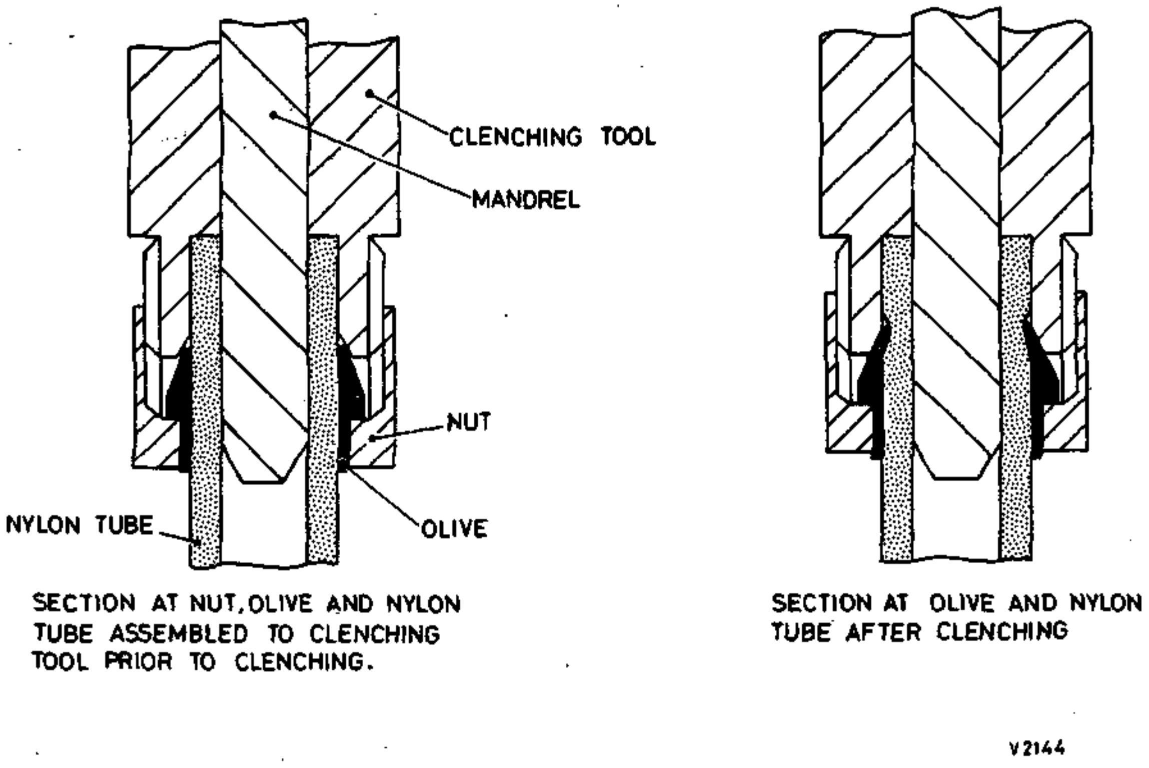
...Pipe couplings - Maintenance practices continued



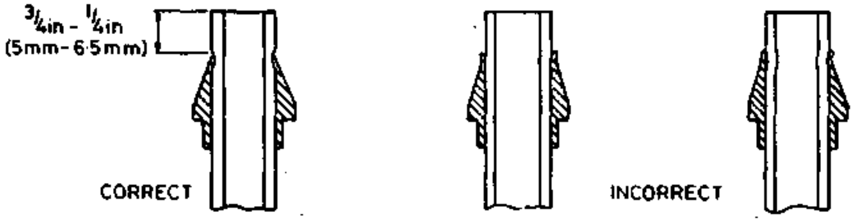
Simplifix coupling
Fig.201



SECTION AT NUT,OLIVE AND NYLON TUBE ASSEMBLED TO CLENCHING TOOL PRIOR TO CLENCHING.

SECTION AT OLIVE AND NYLON TUBE AFTER CLENCHING

Application of olive clenching tool
Fig.202



ENSURE OLIVE IS SWAGED ON TUBE AS SHOWN ON LEFT

V2161

Olive clenching
Fig.203

B. Clench olive to nylon tubing using a coupling body

NOTE : If an en route repair is required at a location where the clenching tools listed in para.1 are not available, satisfactory repairs can be made using the joint coupling body in place of a clenching tool.

CAUTION : USING A COUPLING BODY FOR OLIVE CLENCHING WILL CAUSE RELATIVELY RAPID WEAR TO THE INTERNAL CONICAL BORE OF THE COUPLING. IT IS THEREFORE ESSENTIAL THAT A COUPLING BE USED ONCE ONLY FOR THE FOLLOWING PROCEDURE.

(1) Ensure nylon tube end is square, moisten tube end with de-icing fluid.

(2) Assemble nut and olive over end of tubing and press end of tubing fully home into the recessed end of the coupling body.

(3) Slide nut and olive toward coupling, engage nut and finger tighten ensuring that the spigot on the outer end of the olive is correctly located in the bore of the nut.

(4) CAUTION : IF THE COUPLING IS PART OF AN ASSEMBLED COMPONENT, RESTRAIN THE COUPLING FROM ROTATION DURING THE CLENCHING OPERATION.

Using a suitable pipe ring-spanner, rotate nut from finger tight condition to approximately 315 degrees (5¼ flats of the nut) to clench the olive.

...Pipe couplings - Maintenance practices continued

NOTE : As a guide, it will be found that the tightening torque is relatively constant initially but then rises rapidly. A correctly clenched olive should be obtained if tightening is terminated just after the point where rapid torque increase commences.

(5) Disconnect nut and withdraw olive and tubing from coupling body.

(6) Examine the assembled olive and check that it conforms with the correct appearance shown on Fig.203. Check that the required minimum length extends beyond the clenched end of the olive.

C. Assemble Simplifix coupling

(1) CAUTION : TAKE CARE TO ENSURE THAT THE SEALING RING IS CORRECTLY LOCATED AND NOT TWISTED OR DAMAGED.

Assemble new sealing ring over end of tube.

(2) Insert tubing into coupling body and guide sealing ring into recess at end of coupling body.

(3) Push tubing towards coupling so that the olive retains the sealing ring in position; tighten nut finger-tight.

(4) Tighten nut until tightening-torque just begins to rise rapidly (approximately one half turn from finger tight).

(5) Ensure installed tube assembly is free from all tension.

(6) Wire-lock nut.

(7) Prime and functionally test system (see Chapter 30, AIRFRAME DE-ICING SYSTEM).

## 2. Removal/Installation

### A. General

(1) Following completion of any rectification work on the system or adjacent installations, it is essential to ensure that the pipeline system is free of all residual tension. This is particularly important during removal of distributor panels and wing leading edge sections.

CAUTION : PIPES MUST BE FREE TO FLEX AND NOT BE UNDER TENSION.

(2) In general, when tightening pipe connections to light alloy adapters, pumps etc. care must be taken to ensure that these are not overtightened.

* * *

## STORAGE TANK - MAINTENANCE PRACTICES

1. Unit servicing

   A. Drain de-icing tank

      (1) Place a suitable fluid container at a convenient position outside the aircraft.

      (2) Lead the nylon drain tube, on pump drain, to the fluid container.

      (3) Remove blanking plug from drain tube. Drain de-icing tank.

      (4) Re-fit blanking plug and re-stow drain tube, ensuring that it is clear of the door linkage.

2. Removal/installation

   A. Remove storage tank

      (1) Drain storage tank (see para.1.A.).

      (2) Isolate the relevant electrical circuit (see Chapter 24, GENERAL).

      (3) Unlock and disconnect the pump and tank vent pipe, and pump supply couplings. Discard O-rings. Fit blanks to open ends of pipes.

      (4) Disconnect tank contents electrical cables at terminal block SE.

      (5) Disconnect bonding lead and pump vent pipe 'P' clip. Remove tank attachment bolts and washers. Pull tank clear of mounting.

      (6) Blank exposed orifices on tank.

   B. Install storage tank

      (1) Ensure that grommets on tank mounting are in good condition.

      (2) Position tank on mounting to align bolt holes in with anchor nuts. With washers on bolts, fit and tighten bolts. Secure bonding lead, and pump vent pipe 'P' clip.

      (3) Remove all blanks. Using new O-rings, connect, tighten and wire-lock all pipe couplings (see Chapter 30, PIPE COUPLINGS).

      (4) Check that resistance between tank and earth is not more than 0.05 ohms. Restore bonding connection treatment (see Chapter 20, BONDING FOR ELECTRICAL CONTINUITY).

      (5) Connect tank contents transmitter cables to terminal block SE.

      (6) Restore the electrical supply, and trim contents indicator to read zero (on white dot) using trim screw on end plate.

      (7) Fill tank (see Chapter 12, ICE AND RAIN PROTECTION), and check that indicator reads full.

      (8) Prime and functionally test system (see Chapter 30, AIRFRAME DE-ICING SYSTEM).

* * *

## DE-ICING PUMP - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove de-icing pump

(1) Isolate de-icing pump electrical circuit (ref. Chapter 24-GENERAL).

(2) Remove access panel from bottom of forward vestibule bulkhead.

(3) Drain storage tank (Chapter 30, STORAGE TANK).

(4) Disconnect pump electrical leads from terminal block and bonding lead from pump.

(5) Unlock and disconnect inlet, outlet, vent and drain pipes from pump. Discard O-rings. Fit blanks to disconnected pipes.

(6) Remove attachment bolt from each of the 3 pump mounting bracket anti-vibration mounts and withdraw pump/bracket assembly.

NOTE : If pump is not being refitted, inhibit with oil (Chapter 20-STORES DATA).

#### B. Install de-icing pump

CAUTION : DRY RUNNING OF THE PUMP IS NOT PERMISSIBLE.

(1) Install pump/bracket assembly and secure with bolts removed at operation 1.A.(6).

(2) Using new O-ring seals, connect inlet, outlet, vent and drain to pump (Chapter 30, PIPE COUPLINGS).

(3) Connect pump flying leads to terminal block and bonding lead to pump.

(4) Fill de-icing tank and bleed any air from the pump by loosening vent pipe connection. Tighten vent pipe and check all pump connections for leaks.

(5) Reset circuit breaker.

(6) Prime and functionally test de-icing system (Chapter 30, AIRFRAME DE-ICING SYSTEM).

(7) Wirelock pipe connections.

(8) Fit access panel to forward vestibule bulkhead.

## 2. Inspection/Check

### A. Check de-icing pump motor for brush wear

Equipment required : Stopwatch

(1) Remove de-icing pump/motor assembly.

(2) Unscrew motor cable gland nut and slide the nut and the rubber grommet along the flying leads.

(3) Unscrew both nuts securing the commutator end-cap and remove end cap. Discard associated washers.

(4) Visually inspect the commutator for damage, burning and excessive scoring and reject pump/motor assembly if necessary.

(5) Remove and discard the brush retaining split pins and withdraw brushes. Measure brush lengths from shoulder to nearest point of commutator contact. If either brush is less than 0.26 in. long, both should be discarded and replaced with new items.

(6) Clean inside of end-cap and using dry air remove carbon dust from inside the motor.

(7) Fit serviceable brushes, ensuring that they slide freely within their holders and secure with new split pins.

(8) Fit commutator end-cap to motor and secure with new washers and the retained nuts. NOTE: Do not overtighten nuts.

(9) Slide the grommet along the flying leads, or fit new grommet if necessary, and insert in end-cap and secure with finger tighten gland nut.

(10) Install pump/motor assembly.

(11) Energize d.c. busbars (Chapter 24, General).

(12) Set WING/TAIL ANTICE time switch to run for 1 minute and note that direction of rotation of the motor is clockwise when viewed on the drive end.

(13) When time switch runs to zero, top-up tank and note fluid level in the neck of the tank.

(14) Set WING/TAIL ANTICE time switch to run for 8 minutes and start stopwatch.

(15) When pump stops, after 8 minutes, stop the stopwatch and check that the quantity required to top-up the tank to the level noted at operation (13) is between 1.36 and 1.60 litres.

NOTE: Flow rates should be adjusted to actual running time as indicated by stopwatch.

(16) If flow rates are outside of stated limits, check the following :-

(a) de-icing fluid flows evenly along the full length of each distributor panel.

(b) condition of filter element (ref.30-10-52).

Repeat operations (14) to (15) inclusive; if flow rate remains outside of stated limits, the pump must be replaced with a serviceable unit.

(17) De-energize d.c. busbars.

* * *

## FILTER ASSEMBLY - MAINTENANCE PRACTICES

### 1. Unit servicing

A. Service filter (Fig.201)

(1) If check valve is not fitted to filter inlet, drain fluid storage tank (see Chapter 30, STORAGE TANK).

(2) With a fluid container suitably positioned under filter assembly, unlock and unscrew filter centre bolt. Remove filter bowl, with retaining spring and filter element. Discard sealing washers.

(3) Remove filter element and discard.

(4) Thoroughly wash all components in hot water, using a soft brush.

(5) Examine components for corrosion. Renew affected items.

(6) Using new sealing washers and new filter element, reassemble unit. Ensure that spring is assembled with the smaller end nearest to the filter element.

(7) Tighten and wire-lock centre bolt.

(8) If necessary, fill tank (see Chapter 12, SERVICING - ICE AND RAIN PROTECTION).

(9) Prime and functionally test the system (see Chapter 30, AIRFRAME DE-ICING SYSTEM). Check for leaks at :-

(a) Seal ring between bowl and head casting.

(b) Seal washer under head of centre bolt.

(c) Inlet and outlet connections.

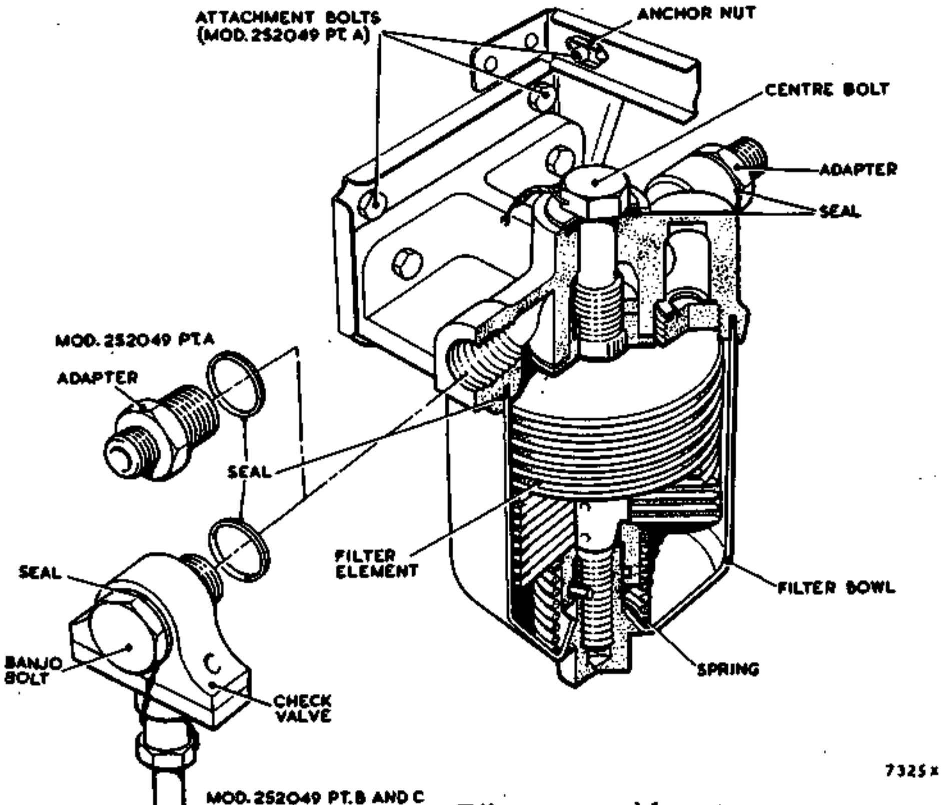
### 2. Removal/Installation

A. Remove filter assembly

(1) Drain fluid storage tank (see Chapter 30, STORAGE TANK ).

(2) Place a suitable fluid container under filter assembly.

(3) Unlock and disconnect inlet and outlet pipes. Discard O-ring seals.



Filter assembly
Fig.201

(4) Mod.252049 Part B and C: Remove filter attachment bolts and withdraw filter assembly.

(5) Mod.252049 Part A: Remove three attachment bolts and washers securing adapter bracket to support beam, and remove filter assembly complete with adapter bracket.

(6) If fitted, remove check valve by removing banjo bolt. Discard seals.

B. Install filter assembly

(1) If fitted, fit check valve to inlet side of filter, using new sealing washers, to align with inlet pipe. Tighten banjo bolt.

(2) If a new filter assembly is to be fitted, transfer the pipe adapter(s) using new seal(s), and the adapter bracket (mod.252049 Pt.A) to the new filter assembly.

(3) Fit filter assembly. Tighten attachment bolts.

(4) Using new O-ring seals, connect the inlet pipe to the check valve or inlet adapter, and outlet pipe to outlet adapter (see Chapter 30, PIPE COUPLINGS).

(5) Fill fluid storage tank (see Chapter 12, SERVICING-ICE AND RAIN PROTECTION).

(6) Prime and functionally test de-icing system (see Chapter 30, AIRFRAME DE-ICING SYSTEM). Check for leaks. Wirelock connections.

* * *

## DISTRIBUTOR PANELS AND METERING TUBES - MAINTENANCE PRACTICES

CAUTION : IF ADJUSTMENT, REPLACEMENT OR REMOVAL/INSTALLATION OF MORE THAN TWO WING DISTRIBUTOR PANELS ON ONE SIDE IS PERFORMED, THE AIRCRAFT MUST BE TEST FLOWN BY A PILOT FAMILIAR WITH THE STALL IDENTIFICATION SYSTEM AND STALL HANDLING CHARACTERISTICS OF THE SERIES F400A AIRCRAFT IN ORDER TO CHECK THE LOW SPEED STALL CHARACTERISTICS.

IT IS ESSENTIAL TO RECORD THE ACCUMULATED DETAILS OF ANY OF THE ABOVE ACTIONS ON THESE PANELS, SO THAT IF A TOTAL OF MORE THAN TWO WING DISTRIBUTOR PANELS ON ONE SIDE HAVE BEEN DISTURBED SINCE THE LAST STALL SYSTEM TEST FLIGHT, A NEW TEST FLIGHT WILL BE DONE.

IF A TEST FLIGHT IS DONE AND THE LOW SPEED STALL CHARACTERISTICS ARE UNACCEPTABLE, REFER TO STRUCTURAL REPAIR MANUAL (SRM) 57-00 PERFORM THE NECESSARY CORRECTIVE ACTIONS AND THEN DO ANOTHER TEST FLIGHT.

### 1.Unit servicing

#### A.Clean distributor panels

(1) Clean surface of distributor panels using a spray of one of the following liquids only and a soft brush :-

Water (with soap or detergents if required)
Aviation fuels
Alcohols (ethyl alcohol, isopropyl alcohol, ethylene glycol or de-icing fluid A.L.5.)

CAUTION : ANY OTHER SOLVENTS MAY DAMAGE THE PLASTIC POROUS MEMBRANE.

(2) If panels removed from aircraft, dry by blowing clean compressed air at 15 - 30 lb/sq.in. through entry connector.

### 2.Removal/Installation

NOTE : Panels are sprayed at their edges with a thin coating of Tygaflor (PTFE) or Rocol (IFL) to act as a release agent for the sealing material. When removing or installing these panels take extreme care to ensure that the coating is not damaged.

#### A.Removal distributor panel

(1) On panel DA/D trip circuit breaker WING TAIL ANTICE PUMP (Grid ref.D8).

(2) Remove distributor panel attachment screws. Withdraw and support panel.

(3) With a fluid container suitably placed under entry connector, unlock and disconnect pipe coupling. Discard O-ring seal.

(4) Fit suitable blanks to entry connector and open pipe end.

#### B.Install distributor panel

Material required :-

| | |
|---|---|
| Gap filling compound .. .. | Hermetite Kwikfill |

(1) Carefully clean off old gap filling compound from leading edge.

(2) Examine distributor panel for signs of damage. Dry panel, if necessary, (see para.1.A.).

(3) Position and support distributor panel.

(4) Remove blanks from entry connector and feed pipe.

(5) Using new O-ring seal, connect pipe coupling. Tighten and wire-lock union nut.

(6) Prime and functionally test airframe de-icing system (see Chapter 30, AIRFRAME DE-ICING SYSTEM).

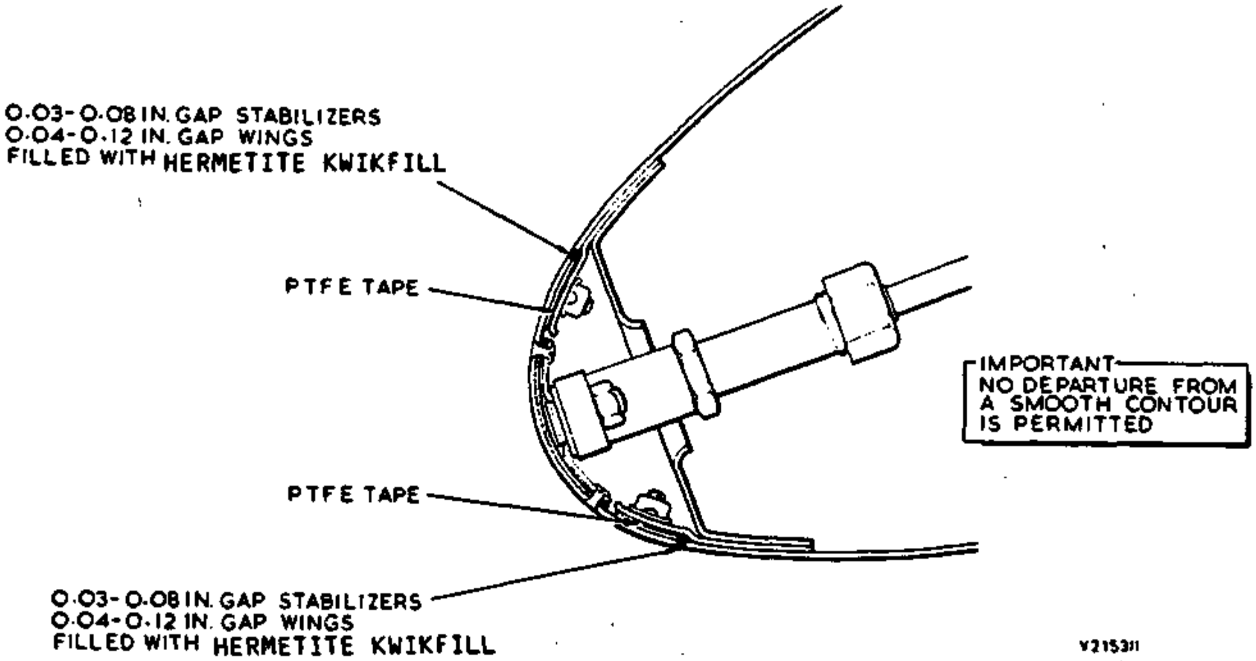
(7) Check pipe couplings for leaks.

(8) Examine PTFE tape along mating surface. If damaged, renew as detailed in para.3.A. Fit and secure distributor panel to leading edge (Fig.201); tighten attachment screws evenly.

(9) Check where visible that contour between distributor panel and leading edge is smooth and continuous (Fig.201) chordwise and spanwise.

CAUTION: ENSURE THAT AFTER ASSEMBLY OF THE DISTRIBUTOR PANEL TO THE LEADING EDGE A SMOOTH AND CONTINUOUS PROFILE IS MAINTAINED, FREE FROM ANY HIGH SPOTS OR DEPRESSIONS. LAMINATED ATTEWELL SHIMS MAY BE FITTED UNDER DISTRIBUTOR PANEL TO MAINTAIN A SMOOTH PROFILE.

(10) Where necessary fill gap between distributor panel and leading edge, using filling compound.


0.03-0.08 IN. GAP STABILIZERS
0.04-0.12 IN. GAP WINGS
FILLED WITH HERMETITE KWIKFILL
PTFE TAPE
IMPORTANT
NO DEPARTURE FROM A SMOOTH CONTOUR IS PERMITTED
PTFE TAPE
0.03-0.08 IN. GAP STABILIZERS
0.04-0.12 IN. GAP WINGS
FILLED WITH HERMETITE KWIKFILL
V215311

Attachment of distributor panel
Fig.201

C. Remove metering tube

(1) Remove distributor panel, as described in para.2.A.

(2) Unlock and remove adapter.

NOTE: When removing adapter from entry connector AC 555, restrain the end nut of connector (see Fig.202) by a spanner on the flats.

CAUTION: IF METERING TUBE IS TO BE REFITTED, IT MUST BE RETAINED WITH THE DISTRIBUTOR PANEL FROM WHICH IT IS REMOVED. TUBES ARE CALIBRATED ACCORDING TO PANEL PART NUMBERS IN ORDER TO ACHIEVE THE CORRECT FLOW RATE.

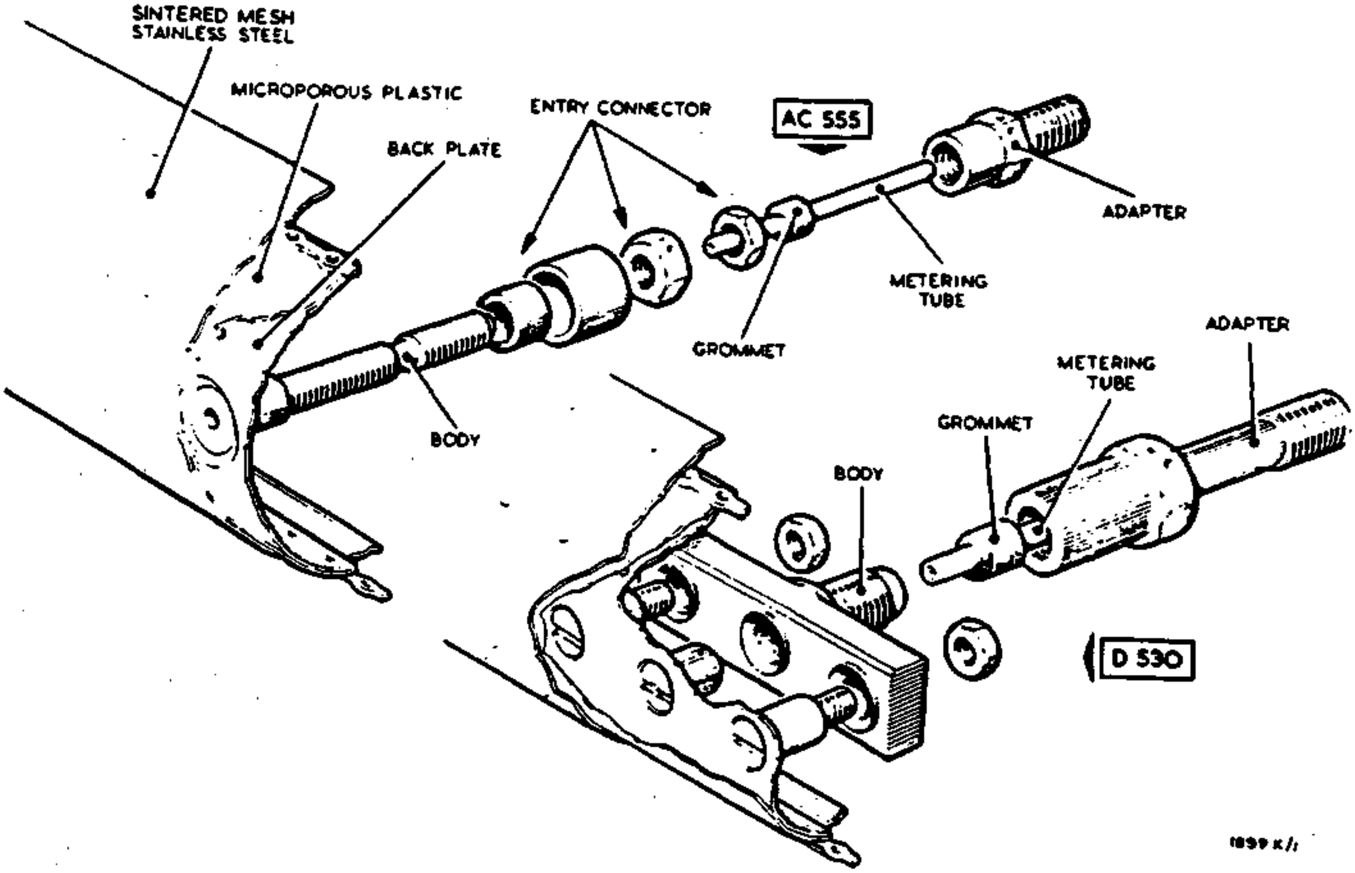
(3) Withdraw metering tube. Discard rubber sealing grommet.

CAUTION: NO FURTHER DISMANTLING OF ENTRY CONNECTORS IS PERMISSIBLE.

D. Install metering tube

(1) Select correct metering tube assembly.

CAUTION: THE METERING TUBE MUST BE IDENTIFIED WITH THE DISTRIBUTION PANEL TO WHICH IT IS BEING FITTED.



Distributor panels and metering tubes
Fig.202

(2) Fit new rubber sealing grommet to metering tube. Check that grommet is correct distance from end of metering tube; this should be 0.625 in. max. for conenctor D 530 and 1.0 in. max. for AC 555.

(3) Insert metering tube into connector body. Ensure grommet rests against body.

(4) Fit adapter. Tighten and wire-lock union nut.

(5) Fit distributor panel (para.2.B.).

## 3.Approved repairs

### A.Renew PTFE tape on distributor mating surface

Materials required:-

| | |
|---|---|
| Thiokol .. .. .. | PR 1422-2 |

PIFE tape, 0.5 in. (fin) 0.625 in. (wing) wide x 0.005 in. thick, pr-etched on one side. Obtainable from

Polypenco Ltd.,
Gate House,
Welwyn Garden City, Herts.

(1) Remove unserviceable tape and clean off old Thiokol.

(2) Bond the tape (etched side) to the underside of the trailing edge in accordance with S.26-4007 (see Chapter 20).

(3) Trim off ends.

* * *

# PITOT HEADS DE-ICING SYSTEM - DESCRIPTION AND OPERATION

The pitot heads, and the masts by which they are attached to the fuselage, are electrically heated. Individual PITOT HEAD ON/off switches control the d.c. supply to the heating element in the left and right-hand pitot heads. An ammeter is connected into each pitot head circuit to provide an indication that the equipment is functioning satisfactorily. A double-pole PITOT MASTS ON/off switch controls the d.c. supply to both mast heating elements.

All control switches are located on the ICE PROTECTION panel of the flight compartment roof panel CG.

The left-hand pitot head heating element is supplied from busbar PE; the right-hand pitot head heating element is supplied from busbar PS2.

The left-hand pitot mast heating element is supplied from busbar PS1; the right-hand pitot mast heating element is supplied from busbar PS2.

* * *

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## PITOT HEAD HEATERS - MAINTENANCE PRACTICES

### 1. Adjustment/Test

#### A. Functionally test pitot head and mast heaters

(1) Energize d.c. busbars (see Chapter 24, GENERAL).

(2) Set PITOT HEADS ON/off switches to ON. Check that pitot heads commence to get warm and that pitot ammeters read approx. 5.7 amp; immediately switch off heaters, check that ammeters read zero.

(3) Set PITOT MASTS ON/off switch to ON. Check that masts commence to get warm; immediately switch off heaters.

CAUTION : THE HEATER SWITCHES MUST NOT BE IN THE ON POSITION FOR LONGER THAN IS NECESSARY TO CHECK CORRECT FUNCTIONING.

#### B. Current consumption test - mast heaters

Equipment required :-

28 volts d.c. electrical supply
Avometer 8

(1) Energize d.c. busbars.

(2) On pitot head and mast assembly to be tested, disconnect earth cable from terminal No.2. Connect Avometer between the earth cable and terminal No.2.

(3) Set PITOT MASTS ON/off switch to ON. Check that Avometer reads 3.7 amp approximately.

(4) Switch off mast switch and check that Avometer reads zero. Connect earth cable to terminal No.2.

(5) Functionally test mast heaters.

(6) De-energize busbars.

* * *

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# WINDSHIELD ICE AND RAIN PROTECTION - DESCRIPTION AND OPERATION

## 1. General

To prevent ice forming on the two forward facing windshield panels (panels A), controlled electrical heating is employed. A manually-operated fluid (methanol) de-icing system is available for use on the left-hand panel should the electrical anti-icing system fail.

Provision is made for the installation of an electrically-operated windshield wiper on each A panel although, in some instances, only the left windshield panel wiper is fitted.

The location of the components comprising the systems are shown on Fig.1 and a schematic wiring diagram of the electrcal anti-icing system is shown on Fig.2.

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### A. Electrical anti-icing system

A heating element (gold film) is incorporated in each A panel on manufacture. The heat outputs from these elements are regulated by individual controllers operating in conjunction with associated control switches and supply (control and overheat) relays.

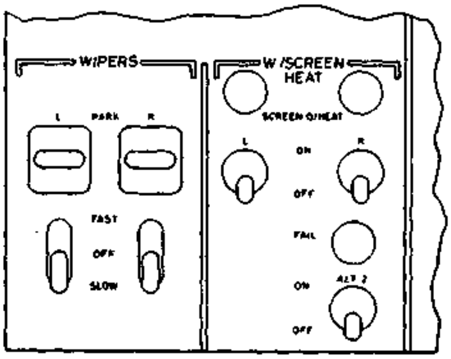
The controllers each comprise two separate channels, control and overheat, each of which effectively consists of a sensing circuit and a magnetic amplifier controlling an integral slave relay; this relay in turn controls the operation of the relevant supply relay. The control channel sensing circuit incorporates two transducters in push-pull configuration, the outputs of which control the channel output magnetic amplifier. The overheat channel sensing circuit is not required to be as sensitive as that of the control channel and, therefore, the transductors are omitted.

The control and overheat sensing elements are integral wth the A panels and it is the change in resistance with temperature of these elements that determines the operating characteristics.

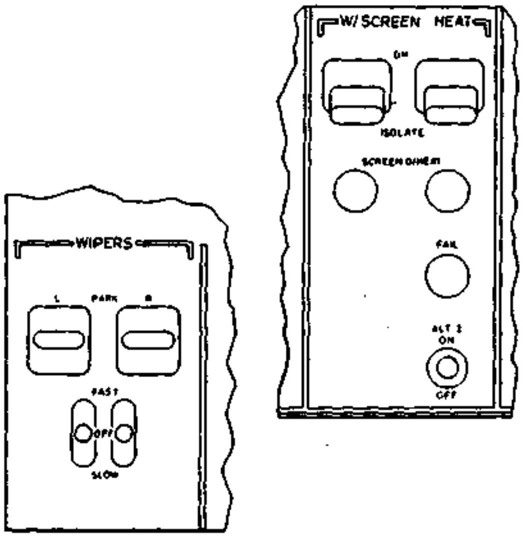
During normal operation the windshield panels are regulated to an overall working temperature of 40°C by the control channel. If, however, a control channel becomes ineffective, the overheat channel operates to discontinue the supply to the heating element when the panel temperature rises to 55°C.

Overall system manual control is effected by operation of a ALT 2 ON/OFF switch and individual window panel control is provided by two ON/ISOLATE switches. Indications of power supply failure and overheat conditions are provided by warning lamps labelled FAIL and SCREEN O/HEAT respectively.

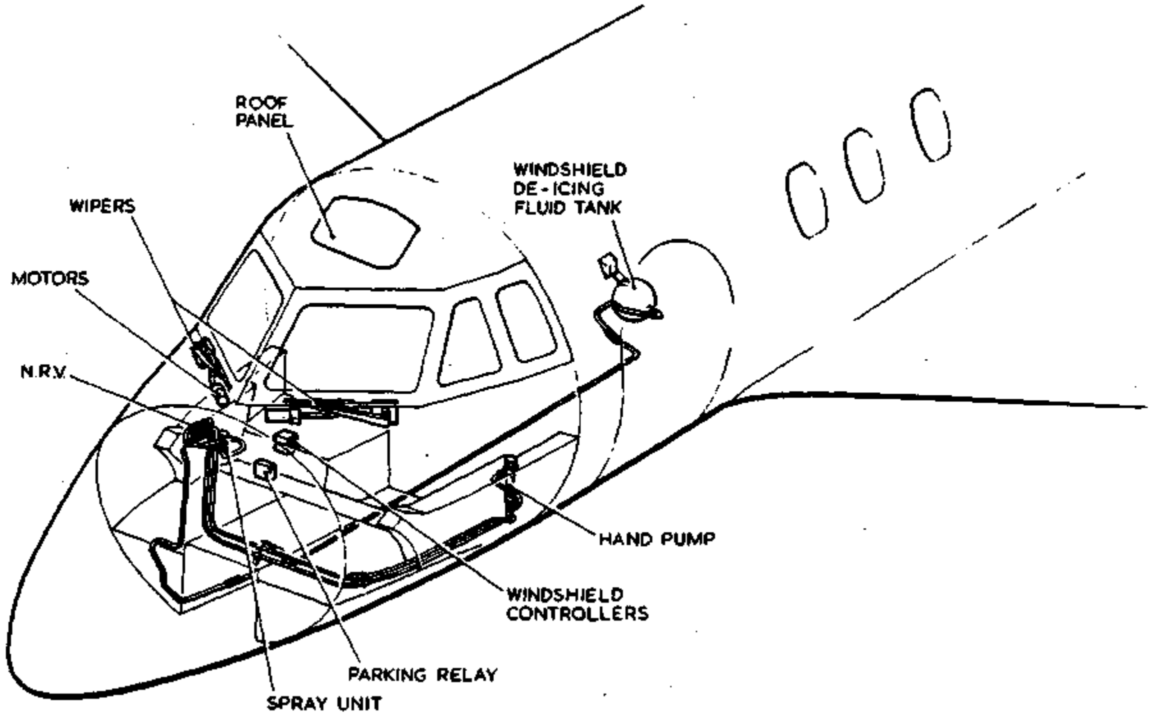
Electrical power for the windshield heating elements is supplied from an a.c. generator, installed on No.2 engine accessory drive gearbox, which provides a single-phase output of 4.4 kVA. This output is controlled by a generator control unit (see Chapter 24, RANDOM FREQUENCY WINDSHIELD POWER SYSTEM) and is connected to the windshield heating elements through the series-connected contacts of the control and overheat relays on panel DA sub-panel H. During



ROOF PANEL PRE AIRCRAFT 25211 (NA739)



ROOF PANEL AIRCRAFT 25211 (NA739) & SUBS.



Location of components
Fig.1

airborne conditions, the a.c. generator output is regulated at 115 ± 2 1/2 volts.

On the ground, the generator control unit (g.c.u.) regulation circuit reduces generator output to 80 ± 3 volts, and prevents the possibility of thermal shock damage to the windshield. This is achieved by utilizing the left main landing gear lever-lock microswitch to energize relay (CJ) on panel ZK, which connects a PE busbar supply to the g.c.u. to cause the voltage regulator to change its point of regulation from 115 volts to 80 volts.

System manual controls and warning lamps are all positioned within the W/SCREEN HEAT section of the flight compartment roof panel CG. Overall system control is by single-pole switch labelled ALT 2 ON/OFF. Individual window panel control is effected by single-pole Left and Right switches labelled ON/ISOLATE. Indications of power supply failure and windscreen overheating are shown by warning lamp indicators; one labelled FAIL and two labelled SCREEN O/HEAT.

Additionally, when power FAIL is indicated, the Central Attention Getting System (c.a.g.s.) flashers on the centre coaming panel will operate until cancelled by the adjacent CANCEL switch, but the power FAIL warning lamp will remain on.

The serviceability of the overheat warning lamp filaments can be checked by using the lamp press-to-test facility.

B. Fluid anti-icing system

Fluid for windshield standby anti-icing system is drawn from a tank containing methanol by a manually-operated pump and applied to the left-hand panel only by a spray unit fitted forward of the windshield.

C. Windshield wipers

The windshield wipers are driven independently of each other by electric motors through their respective converters which provide the reciprocating action necessary for wiper operation. The motors and converters are coupled by flexible drives. Each motor incorporates overload protection, provided by an integral automatic reset thermoprotection device, which temporarily de-energizes the motor during fault conditions. Radio noise filters are fitted in the motor and are also connected into the motor external electrical circuit.

Power supplies for left and right-hand wipers are from PE and PS busbars respectively.

Each wiper system is controlled by two switches on flight compartment roof panel CG; a three-position FAST-OFF-SLOW switch giving two-speed motor control and a PARK off switch.

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parking position and rotates the cam to allow the microswitch contacts to change over. This causes the motor to be short-circuited and rotation ceases. The short-circuit is removed on releasing the switch, thus priming the circuit for further operation.

NOTE : The microswitch operates continually during wiper operation but is only effective when the parking switch is held at PARK.

## 2. Operation

### A. Electrical anti-icing system (Fig.2)

NOTE : Right-hand channel operation described, left-hand channel similar.

On the ground with busbars energized and generator output contactor de-energized, the generator output line to the windshield heaters is open-circuited; a supply from PE busbar lights W/SCREEN HEAT FAIL lamp and operates the c.a.g.s. flashers.

With No.2 engine running and ALTERNATOR 2 switch set to ON, a PS2 supply is connected to the generator control unit (g.c.u.) to energize its supply control circuits and generator excitation. As generator output builds-up, and provided correct conditions exist, transistor Q110 is switched 'on' to complete 'earth return' for generator control relay (AM). This relay is energized from busbar PS2 via ALTERNATOR 2 switch, and connects a supply from busbar PS2, which provides a full excitation signal to the generator field which is controlled by the g.c.u. voltage regulator circuit. The relay contacts also connect PS2 busbar supply to energize the generator output contactor which connects generator output to windshield heater elements and disconnects supply to FAIL lamp and c.a.g.s. flashers.

The left-hand landing gear leverlock microswitch (weight-on-wheels) connects a supply from PE2 busbar to energize relay CJ which then connects a PE busbar supply to the g.c.u. regulation circuit to effect a reduced generator output when the system is operating on the ground. A PS2 supply is simultaneously connected into the windshield controller control and overheat channel slave relays. When the contacts of the overheat slave relay are relaxed, a PS2 supply is automatically connected to energize the external overheat relay 'C'.

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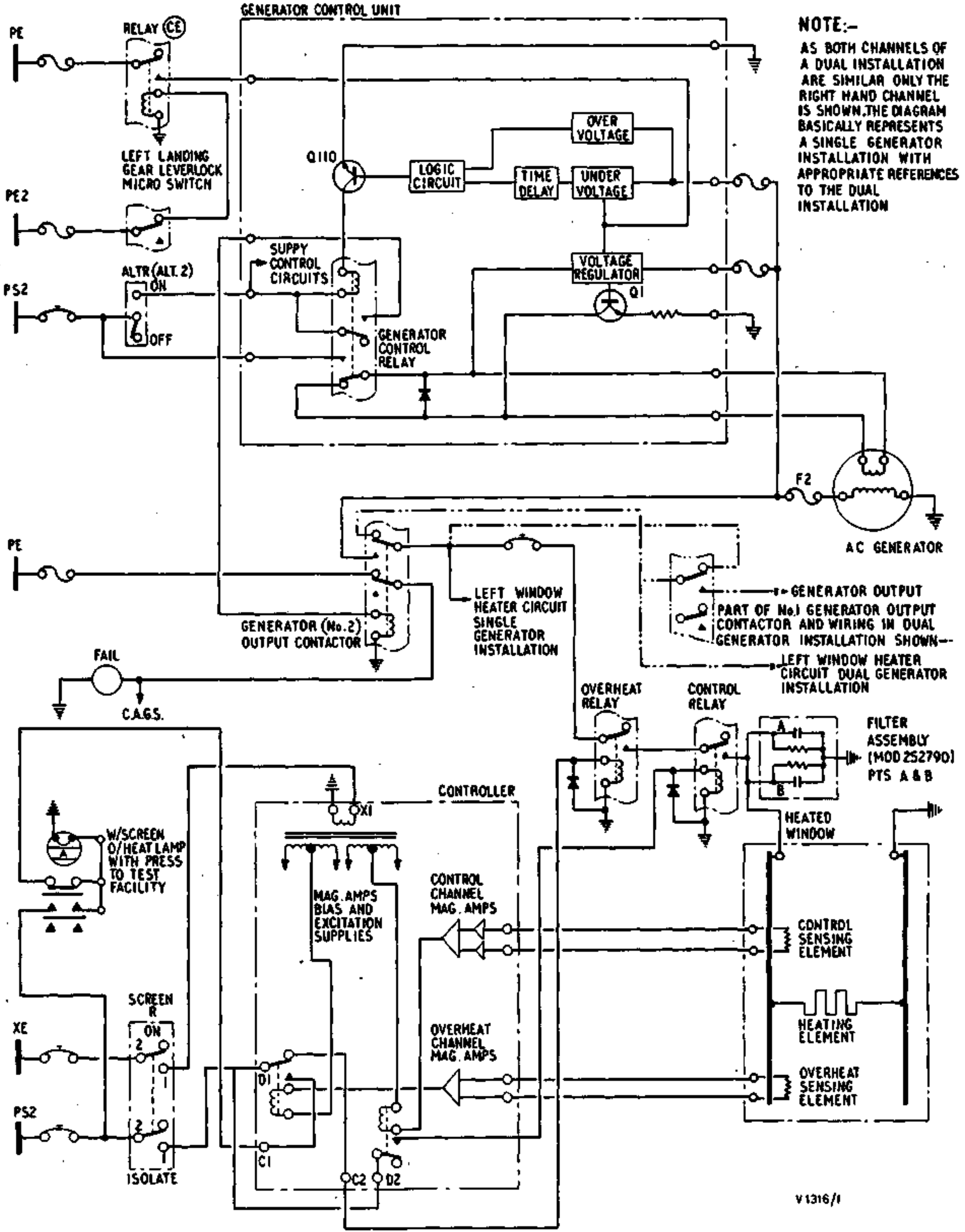
GENERATOR CONTROL UNIT
PE
RELAY (CE)
LEFT LANDING GEAR LEVERLOCK MICRO SWITCH
PE2
PS2
ALTR (ALT. 2)
ON
OFF
Q110
LOGIC CIRCUIT
OVER VOLTAGE
TIME DELAY
UNDER VOLTAGE
SUPPY CONTROL CIRCUITS
VOLTAGE REGULATOR
Q1
GENERATOR CONTROL RELAY
F2
A C GENERATOR
PE
GENERATOR (No.2) OUTPUT CONTACTOR
LEFT WINDOW HEATER CIRCUIT SINGLE GENERATOR INSTALLATION
GENERATOR OUTPUT
PART OF No.1 GENERATOR OUTPUT CONTACTOR AND WIRING IN DUAL GENERATOR INSTALLATION SHOWN
LEFT WINDOW HEATER CIRCUIT DUAL GENERATOR INSTALLATION
FAIL
C.A.G.S.
OVERHEAT RELAY
CONTROL RELAY
A
B
FILTER ASSEMBLY (MOD 252790) PTS A & B
HEATED WINDOW
CONTROLLER
X1
A
W/SCREEN O/HEAT LAMP WITH PRESS TO TEST FACILITY
MAG. AMPS BIAS AND EXCITATION SUPPLIES
CONTROL CHANNEL MAG. AMPS
CONTROL SENSING ELEMENT
HEATING ELEMENT
OVERHEAT CHANNEL MAG. AMPS
OVERHEAT SENSING ELEMENT
SCREEN R
ON
XE
2
1
PS2
2
1
ISOLATE
D1
C1
C2
D2
V1316/1

NOTE:-
AS BOTH CHANNELS OF A DUAL INSTALLATION ARE SIMILAR ONLY THE RIGHT HAND CHANNEL IS SHOWN. THE DIAGRAM BASICALLY REPRESENTS A SINGLE GENERATOR INSTALLATION WITH APPROPRIATE REFERENCES TO THE DUAL INSTALLATION

Windshield anti-icing and power system schematic wiring diagram
Fig.2

... Windshield ice and rain protection - Description and operation continued

When a weight-off-wheels condition occurs, relay CE is de-energized and its contacts relax to disconnect PE busbar supply to the g.c.u. which will then regulate generator output at 115 volts.

In addition to the d.c. inputs to the windshield controller an 115 volts 400 Hz a.c. supply will be supplied to the appropriate controller when W/SCREEN HEAT Left or Right switch is selected ON. The controller control channel slave relay will now be energized and the contacts of both slave relays will be positioned to enable the externally connected control and overheat relays to become energized; the relay contacts change-over and connect the generator output to the windshield heater elements.

As the temperature of the window panels rises, the resistance of the sensing elements increases accordingly (positive resistance/temperature characteristic). The outputs of the control channel magnetic amplifier, however, decrease with increase of sensing element resistance until at the control operating temperature (40 deg. C) they are at a minimum. Under this condition, the associated slave relays are de-energized (open) to cut off supplies to the coils of the control relays which open to discontinue the supplies to the heating elements.

As the window panels cool the amplifier outputs increase in inverse proportion to the resistance of the sensing elements until, at pre-determined temperature, the increase is sufficient to close the relays and recommence the control temperature cycle.

Should the control channel become inoperative due to a short circuit the window panel temperature will continue to rise with consequent increase in sensing element resistance and overheat magnetic amplifier output, until at 55 deg. C the amplifier output is sufficient to close the controller integral overheat slave relay, thus causing the external overheat relay to de-energize, cutting off supplies to the heating elements. Additionally, when the slave overheat relay closes, the appropriate SCREEN O/HEAT lamp illuminates.

Setting the SCREEN Left or Right switch to ISOLATE disconnects the electrical supply to the control relay, the relay contacts revert to the relaxed condition and isolate the panel heater element electrical supply.

Setting ALT 2 switch to OFF de-energizes the related g.c.u. control relay, interrupts the associated generator excitation supply, and de-energizes the generator output contactor. The generator de-excites and the output relay disconnects the generator output to the winshield heater elements. The ALT 2 FAIL lamp lights and the c.a.g.s. flashing lamps operate.

* * *

# WINDSHIELD ELECTRICAL DE-ICING SYSTEM - MAINTENANCE PRACTICES

## 1. Adjustment/Test

### A. Functionally test windshield electrical anti-icing system using test set HSA 25YTS31E-5A

Equipment required :-

Avometer 8 or equivalent
Test set .. .. HSA 25YTS31E-5A and associated cable assemblies.

NOTE : If test set HSA 25YTS31E-5A is not available carry out operations listed in para.1.B.

(1) On panel DA sub-panel D trip the following circuit breakers :-

Right-side window - W/SCREEN HEAT CONTROL R.H. (grid ref.D3)
W/SCREEN HEAT CONTROL R.H. (grid ref.D5)
W/SCREEN HEAT CONTROL R.H. (grid ref.E3)
Left-side window - W/SCREEN HEAT CONTROL L.H. (grid ref.D2)
W/SCREEN HEAT CONTROL L.H. (grid ref.D4)
W/SCREEN HEAT CONTROL L.H. (grid ref.C3)

(see Chapter 24, GENERAL).

(2) At panel DA, disconnect the windshield gold film supply cable from relay AF (left window) terminal connection A1 and connect test set cable L-A1. At relay AD (right window) disconnect cable terminal connection A1 and connect test set cable H-A1. Also connect test set cable TR8R to a suitable earth (relay X2).

(3) Gain access at panel DA to the windshield system controllers AW and AU. Disconnect windshield control and overheat sensing elements at terminals A1, A2, B1 and B2. Connect test set to controllers as follows :-

Cables (PORT) coded A-A1, A-A2, A-B1, A-B2, to the respective terminals on AW (port) windshield system controller.

Cables (STARBD) coded E-A1, E-A2. E-B1, E-B2 to the respective terminals on AU (starboard) windshield system controller.

(4) Connect Avometer to terminals adjacent to the SUPPLY ON lamp on the test set and select 250 volts a.c. range.

(5) Set the test set CONTROL and O-HEAT potentiometer knobs, together with their associated free dials, fully anti-clockwise and align the arrows marked on the knobs and dials.

(6) Set selector switch on test set to P and ensure WINDSCREEN HEAT Left and Right switches are ON.

(7) Reset circuit breakers.

(8) Energize the d.c. and a.c. busbars (see Chapter 24, GENERAL).

(9) Check ALT 2 FAIL lamp lights and c.a.g.s. lamps are flashing. Cancel c.a.g.s flashers.

(10) Run right-hand (No.2) engine at idling r.p.m. (see Chapter 71, GENERAL) and operate the ALT 2 switch to ON. Check that ALT 2 FAIL lamp goes out, test set SUPPLY ON light is lit and Avometer reads 80 ± 3 volts.

(11) Slowly turn CONTROL potentiometer knob in a clockwise direction until the SUPPLY ON light extinguishes and Avometer reads zero volts. Check that the arrow on the knob lies within the TRIP sector on the fixed dial.

(12) Ensuring the free dial remains stationary at the position in operation (11), slowly turn the CONTROL potentiometer knob anti-clockwise until the SUPPLY ON light comes on and the Avometer reads 80 ± 3 volts. Check that the arrow on the knob lies within the RESET sector of the free dial.

(13) Reset the CONTROL knob and dial fully anti-clockwise, aligning the arrows on the knob and dial.

(14) Slowly turn O-HEAT potentiometer knob in a clockwise direction until the SUPPLY ON light goes out and the Avometer reads zero volts. Check that the arrow on the knob lies within the TRIP sector on the fixed dial, and the Left SCREEN O/HEAT lamp lights.

(15) Ensuring the free dial remains stationary at the position in operation (14) slowly turn the O-HEAT potentiometer knob anti-clockwise until the SUPPLY ON light comes on and the Avometer reads 80 ± 3 volts. Check that the arrow on the knob lies within the RESET sector of the free dial and the Left SCREEN O/HEAT light extinguishes.

(16) Reset the O-HEAT knob and dial fully anti-clockwise, aligning the arrows on the knob and dial.

(17) Set W/SCREEN HEAT Left switch to the ISOLATE position and check that the SUPPLY ON light goes out and the Avometer reads zero volts.

(18) Return the W/SCREEN HEAT Left switch to ON, and check that the SUPPLY ON light comes on and the Avometer reads 80 ± 3 volts.

(19) Turn the test set selector switch to the central position (off).

(20) Repeat operations (6) to (18) for right-hand windshield panel, reading S for P and right for left.

(21) Set the ALT 2 switch to OFF; check that the SUPPLY ON light goes out, ALT 2 FAIL lamp lights, c.a.g.s. lights are flashing and the Avometer reads zero volts.

(22) Run down right-hand engine (see Chapter 71, GENERAL) and de-energize d.c. and a.c. busbars.

(23) Disconnect test set and Avometer, and reconnect and secure windshield panel electrical supply connections.

(24) Start right-hand engine (Chapter 71, GENERAL). Select ALT 2 and WINDSCREEN HEAT Left and Right switches to ON. Check operation of screen heating by feel and ensure that neither SCREEN O/HEAT warning lamp lights. Select WINDSCREEN HEAT Left and Right switches to ISOLATE and ALT 2 switch to OFF. Shut down right-hand engine (Chapter 71, GENERAL).

B. Functionally test windshield electrical anti-icing system without use of test set HSA 25YTS31E-5A

Equipment required :-

AVO Model 8 or equivalent
Decade resistance box (0 to 1000 Ohms) or equivalent.

NOTE : The procedure checks the left-hand system with right-hand system references in parentheses.

(1) On panel DA, sub-panel D, trip the following circuit breakers :-

W/SCREEN HEAT CONTROL LH (RH) (grid ref.D2(D3))
W/SCREEN HEAT CONTROL LH (RH) (grid ref.D4(D5))
W/SCREEN HEAT CONTROL LH (RH) (grid ref.C3(E3))

(2) At panel DA, disconnect and insulate cable from relay AF (AD) terminal A1, and connect the AVO red lead to the terminal. Select AVO to read 250V a.c. full scale. Connect AVO black lead to suitable airframe earth.

(3) Gain access to windshield anti-icing controller AW (AU) by lowering sub-panel E on panel DA. Disconnect and insulate windshield control sensing element at terminals A1 and A2. Set Decade box resistance to 100 Ohms and connect it across terminals A1 and A2 controller AW (AU).

(4) Reset circuit breakers.

(5) Energize d.c. and a.c. busbars (Chapter 24, GENERAL).

(6) Check that the ALT 2 FAIL lamp lights and the c.a.g.s. lights are flashing. Cancel c.a.g.s. flashers.

(7) Start and run right-hand engine at idle r.p.m. (Chapter 71, GENERAL), and select the ALT 2 switch on roof panel CG to ON. Check that the ALT 2 FAIL lamp goes out.

(8) Select WINDSCREEN HEAT L (R) switch on roof panel CG to ON and check that AVO reads 80 ± 3 volts.

(9) Gradually increase Decade box resistance until AVO reading drops to zero. Resistance should be 110.2 to 111.2 Ohms. Note result.

(10) Gradually decrease Decade box resistance until AVO reading rises to 80 ± 3 volts. Resistance should be 0.5 Ohms less than that noted at operation (9).

(11) Select SCREEN L (R) switch to OFF, disconnect Decade box from terminals A1 and A2, and reconnect sensor wiring. Disconnect and insulate overheat sensor wiring at terminals B1 and B2. Connect Decade box across terminals B1 and B2 of controller.

(12) Select SCREEN L (R) switch to ON and check that AVO reads 80 ± 3 volts.

(13) Gradually increase Decade box resistance until AVO reading drops to zero. Resistance should be 116.1 to 121.4 Ohms. Note result. Check that relevant SCREEN O/HEAT lamp lights.

(14) Gradually decrease Decade box resistance until AVO reading rises to 80 ± 3 volts. Resistance should be between 5 and 8 Ohms less than that noted at operation (13). Check that the warning lamp goes out.

(15) Select SCREEN L (R) and ALT 2 switches to OFF.

(16) Shut down right-hand engine (Chapter 71, GENERAL).

(17) De-energize d.c. and a.c. busbars.

(18) Trip circuit breakers listed at operation (1).

(19) Disconnect AVO and Decade resistance box and reconnect aircraft wiring to relay AF and controller AW (AU).

(20) Reset circuit breakers, and close and secure all disturbed panels.

(21) Start right-hand engine (Chapter 71, GENERAL). Select ALT 2 and WINDSCREEN HEAT Left and Right switches to ON. Check operation of screen heating by feel and ensure that neither SCREEN O/HEAT warning lamp lights. Select WINDSCREEN Left and Right switches to ISOLATE and ALT 2 switch to OFF. Shut down right-hand engine (Chapter 71, GENERAL).

2. Approved repairs (Fig.201)

Equipment and materials required :-

| | |
|---|---|
| Crimping tool .. .. .. | 575091 (AMP) |
| Lug .. .. .. .. | 151439 (AMP) |
| Cable .. .. .. .. | Minyvin 22 |

When failure of a sensor(s) occurs the panel can continue to be used by adopting one of the following remedial actions :-

A. Failure of a single sensor element

(1) Utilize the spare element (if in a serviceable condition) by reconnecting the cable from the B terminal to $B^1$ or from D to $D^1$ as appropriate.

B. Failure of both overheat temperature sensors AB and $AB^1$

(1) Alter the wiring as follows :-

| Sensing element terminal | Existing | | Action | Modified | |
|---|---|---|---|---|---|
| | Right hand | Left hand | | Right hand | Left hand |
| A | CU3 | CM3 | Disconnect, insulate and stow | - | - |
| B | RA2R | RA5R | Disconnect, insulate and stow | - | - |
| C | RA3R | RA4R | Reconnect to | RA1R | RA6R |
| D | RA1R | RA6R | Reconnect to | RA3R | RA4R |
| $D^1$ | - | - | Add new Minyvin 22 cable if not already fitted (coded $D^1$ at each end) | CU3 | CM3 |

(2) Cables which are too short to be rerouted are to be disconnected at both ends, insulated and stowed and new cables installed. When a new panel is fitted the original cables are to be brought back into use and the new cables insulated and stowed.

C. Failure of both control sensors CD and $CD^1$

(1) Alter the wiring as follows :-

| Sensing element terminal | Existing | | Action | Modified | |
|---|---|---|---|---|---|
| | Right hand | Left hand | | Right hand | Left hand |
| C | RA3R | RA4R | Disconnect, insulate and stow | - | - |
| D | RA1R | RA6R | Disconnect, insulate and stow | - | - |
| A | CU3 | CM3 | Reconnect to | RA2R | RA5R |
| B | RA2R | RA5R | Reconnect to | CU3 | CM3 |
| $B^1$ | - | - | Add new Minyvin 22 cable if not already fitted (coded $B^1$ at each end) | RA3R | RA4R |

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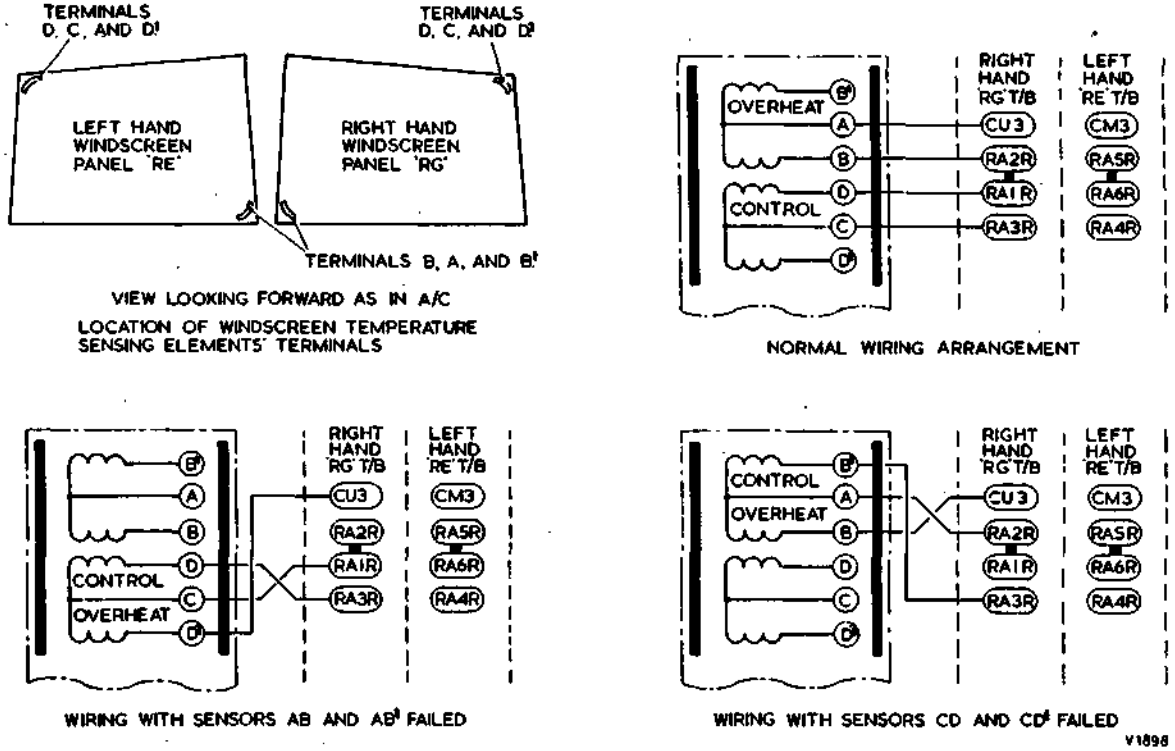

VIEW LOOKING FORWARD AS IN A/C
LOCATION OF WINDSCREEN TEMPERATURE SENSING ELEMENTS' TERMINALS

NORMAL WIRING ARRANGEMENT

WIRING WITH SENSORS AB AND AB' FAILED

WIRING WITH SENSORS CD AND CD' FAILED

Windscreen panel sensor wiring
Fig.201

(2) Cables which are too short to be rerouted are to be disconnected at both ends, insulated and stowed and new cables installed. When a new panel is fitted, the original cables are to be brought back into use and the new cables insulated and stowed.

* * *

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## WINDSHIELD FLUID DE-ICING SYSTEM - MAINTENANCE PRACTICES

### 1.Adjustment/Test

#### A.Functional test of fluid de-icing system

(1) Make sure that the windshield de-icing tank is full (see Chapter 12, SERVICING - ICE AND RAIN PROTECTION).

(2) Operate the windshield fluid de-icing system handpump, and check that fluid is ejected from the spray nozzle towards the windshield panel.

NOTE: In still air conditions the de-icing fluid will not be delivered directly onto the windshield panel.

(3) If no fluid is delivered onto the windshield panel, do the clear spray nozzle procedure (see para.2.B. below).

(4) Clean the de-icing fluid from the aircraft structure.

(5) Replenish the windshield de-icing tank (see Chapter 12, SERVICING-ICE AND RAIN PROTECTION).

### 2.Removal/Installation

CAUTION: WHEN MAKING PIPE CONNECTIONS IN THE FLUID DE-ICING SYSTEM, THE ONLY APPROVED THREAD LUBRICANT IS METHANOL.

#### A.Remove spray nozzle

(1) Get access to the nose equipment bay.

(2) Put a suitable container below the spray nozzle and disconnect the de-icing pipe.

(3) Remove the thin nut, washer and spray nozzle from the aircraft.

NOTE: Make a temporary mark to show the position of the holes in the spray nozzle and to help the installation procedure.

(4) Put blanking caps on all line ends.

## B. Clear spray nozzle

Equipment required:

Supply of dry, compressed air.

WARNING: DO NOT POINT A COMPRESSED AIR OUTLET AT YOURSELF OR OTHER PERSONS. COMPRESSED AIR CAN CAUSE INJURY.

(1) Using dry compressed air, carefully clear the spray nozzle fluid path.

## C. Install spray nozzle

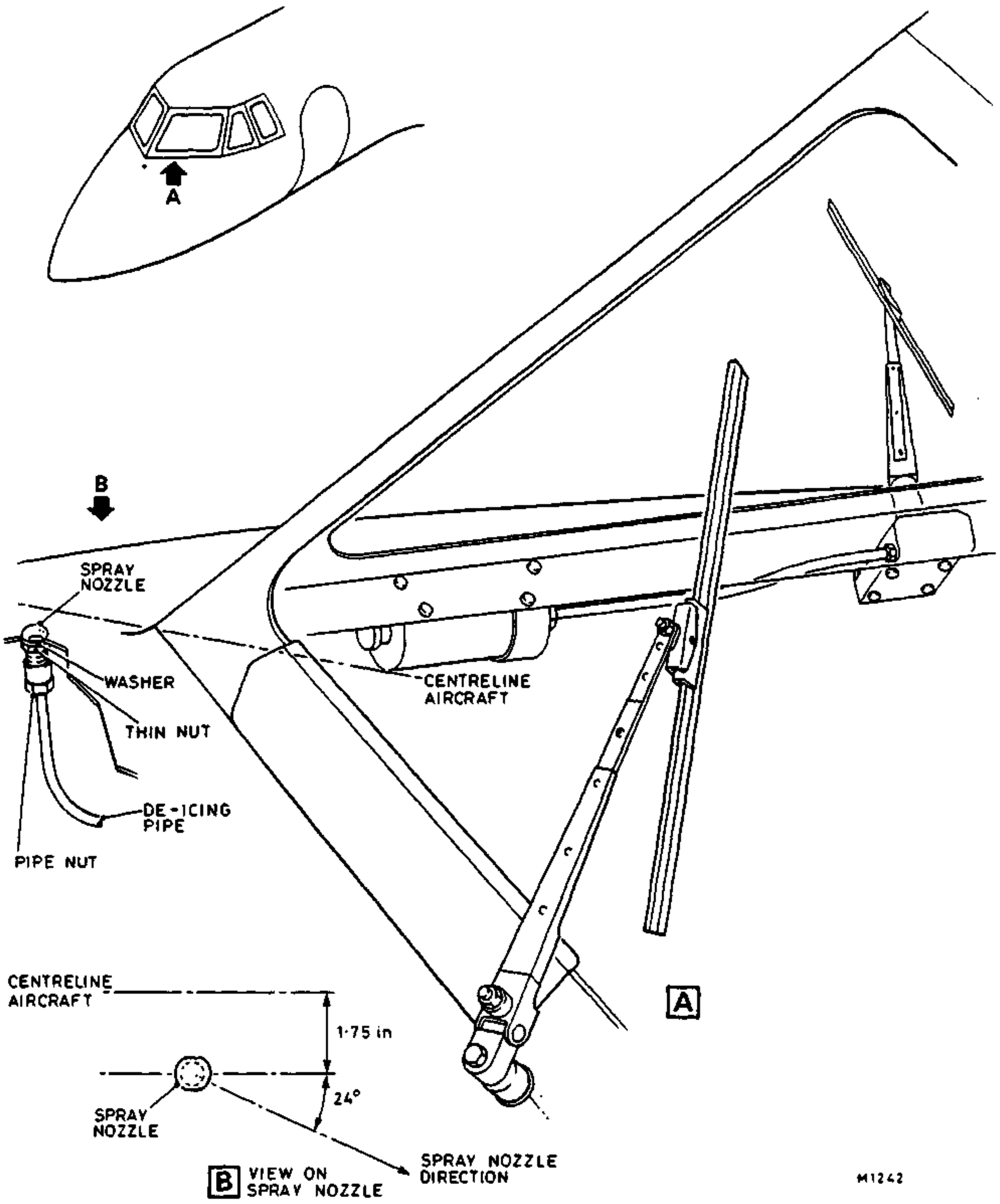
(1) Using the temporary marks made in the removal procedure, put the spray nozzle in position so that the holes point to the windshield panel (24° from the aircraft centre line).

(2) Secure the spray nozzle with the washer and thin nut.

(3) Remove the blanking caps from the line ends and connect the de-icing pipe to the spray nozzle.

(4) Do a functional test of the fluid de-icing system (see para.1.A. above).

(5) Remove all tools, materials and equipment from the work area. Make sure the area is clean.



Windshield fluid de-icing system
Fig.201

## DE-ICING FLUID STORAGE TANK - MAINTENANCE PRACTICES

### 1. Removal/Installation

### A. Remove fluid storage tank

(1) Remove access panel under wing/fuselage fairing and position container under pipe unions adjacent to storage tank. Unlock and disconnect pipe unions. Drain storage tank.

(2) Disconnect bonding flex at top of tank.

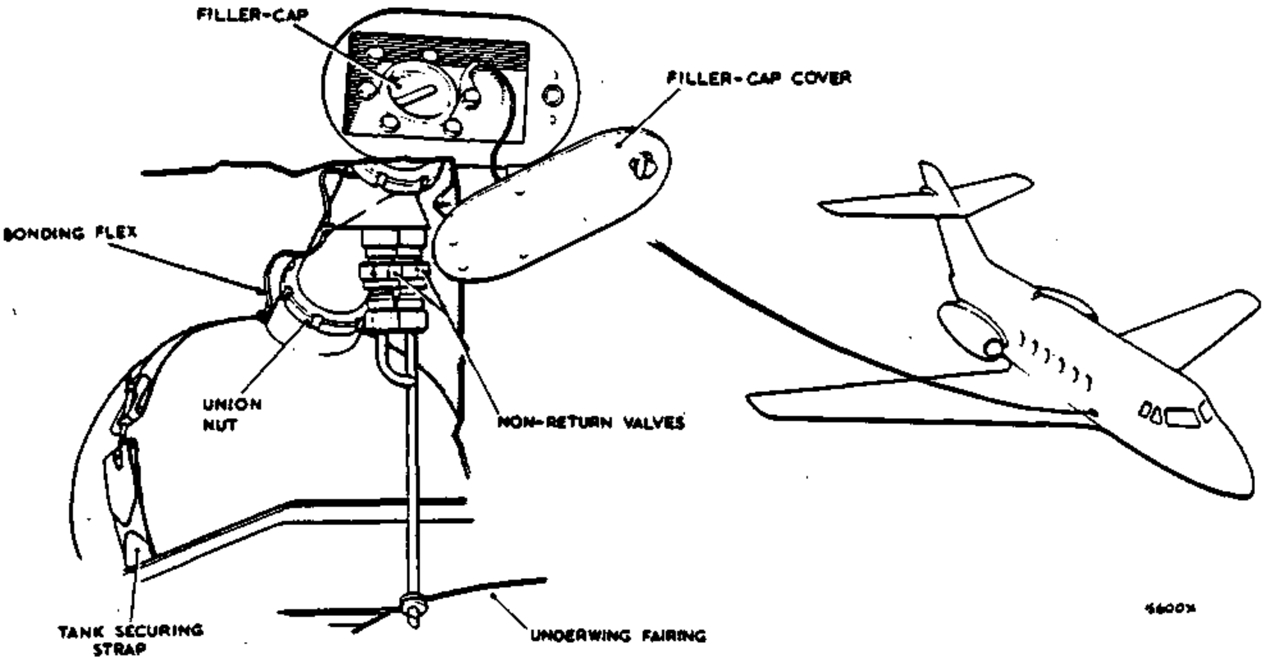
(3) Disconnect union nut attaching tank to filler neck. Discard O-ring seal.

(4) Disconnect tank securing strap and remove storage tank.

### B. Install fluid storage tank

(1) Position tank in mounting cradle. Align tank inlet with filler neck. Position tank securing strap. Tighten and wire-lock wing-nut.

(2) Using new O-ring seal, connect tank to filler neck. Tighten and wire-lock union nut.



De-icing fluid storage tank
Fig.201

(3) Connect bonding flex to top of tank in accordance with DHS 645 (see Chapter 20. BONDING FOR ELECTRICAL CONTINUITY). Check that resistance between tank and earth is not more than 0.05 ohm.

(4) Connect pump suction pipe unions to tank. Tighten and wire-lock union nuts.

(5) Fill fluid storage tank. Check all unions for leaks.

(6) Functionally test system (see Chapter 30, WINDSHIELD FLUID DE-ICING SYSTEM).

(7) Top-up storage tank.

(8) Fit and secure access panel.

* * *

## WINDSHIELD WIPER SYSTEM - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove converter

(1) Unlock and remove bolt securing actuating arm to converter. Remove actuating arm complete with wiper blades.

NOTE : If the same wiper assembly is to be refitted, carefully mark arm in relation to converter shaft.

(2) Unlock and remove flexible drive from converter.

(3) Remove converter.

#### B. Install converter

(1) Examine converter for signs of damage.

(2) Position and secure converter.

(3) Connect flexible drive to converter. Tighten and wire-lock union nut.

(4) Fit actuator arm and wiper blade. Tighten and wire-lock attachment bolt.

NOTE : If original arm is refitted, align marks made during removal and functionally test.

(5) If a new arm has been fitted adjust actuator arm and wiper blade (para.2.A.).

#### C. Remove wiper motor

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Disconnect electrical cables.

(3) Unlock and disconnect flexible drive from motor.

(4) Remove motor complete with mounting plate.

(5) If a new motor is to be fitted, remove special bolts attaching motor to mounting plate.

NOTE : These bolts are locked with Loctite, grade B and resistance to removal will be felt.

#### D. Install wiper motor

Materials required :-

| | |
|---|---|
| Thread locking compound .. .. | Loctite, grade B |

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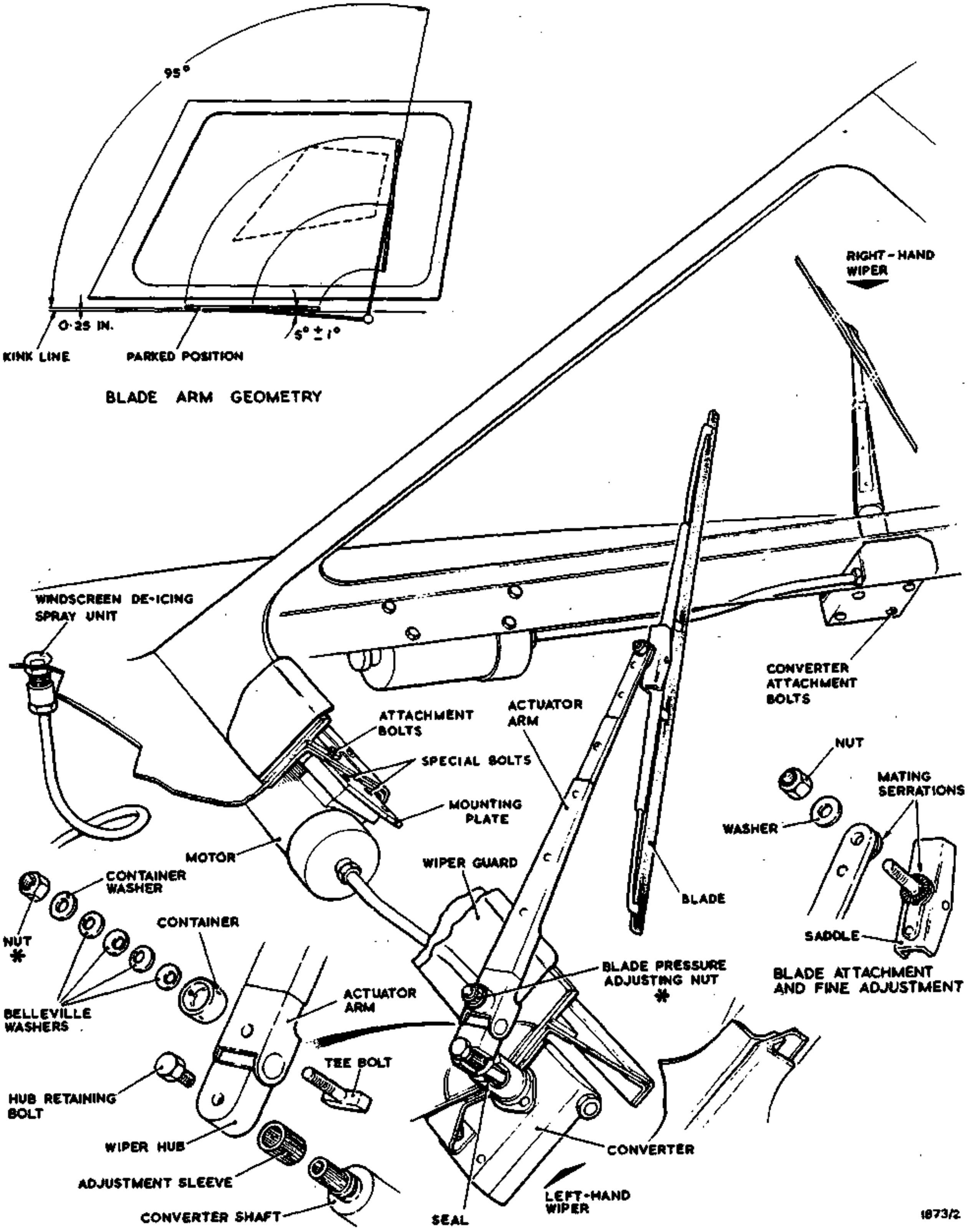

Windshield wiper installation
Fig.201

...Windshield wiper system - Maintenance practices continued

(1) If a new motor is being fitted, secure motor to mounting plate; lock special bolts with compound.

(2) Secure mounting plate to aircraft structure. Tighten attachment nuts.

(3) Connect flexible drive to motor. Tighten and wire-lock union nuts.

(4) Connect electrical cables.

(5) Restore relevant electrical circuit.

(6) Functionally test windshield wiper (para.2.B.).

## 2. Adjustment/Test

### A. Adjust actuator arm and wiper blade

(1) Energize d.c. busbars (see Chapter 24, GENERAL).

(2) Prior to fitting actuator arm and wiper blade, set WIPER switch to the SLOW speed position and check that converter shaft oscillates.

(3) Set the WIPER switch to OFF, so that converter stops at approximately the end of its stroke in the parked position. Several attempts may be necessary to achieve this.

(4) De-energize the d.c. busbars (see Chapter 24, GENERAL).

(5) Mount actuator arm and wiper blade on converter shaft at parked position:-

  (a) Insert adjustment sleeve in actuator arm (any position) and place on converter shaft as close to parked position as possible.

  (b) Estimate error of arm position (in inches) and divide by 0.028 Example: Error 0.375 in. to right; 0.375 in. divided by 0.028 is approximately 13, and this is the number of teeth that the adjustment sleeve is to be rotated.

  (c) Remove arm and adjustment sleeve; rotate sleeve the calculated number of teeth in the same direction as arm must be moved.

  (d) Outside sleeve teeth will now locate actuator arm in desired position, tighten and wire-lock the hub retaining bolt.

(6) Adjust blade pressure against glass panel (see para.3.A.).

(7) Energize the d.c. busbars (see Chapter 24, GENERAL).

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...Windshield wiper system - Maintenance practices continued

(8) CAUTION : DO NOT OPERATE WINDSHIELD WIPERS OVER DRY GLASS.

Thoroughly wet the windshield(s), and maintaining this wetted condition set the WIPER switch to the FAST position for a minimum period of 30 seconds. Ensure that the wiper blade tip is just touching the nose skin as it reverses direction, and observe that the wiped area satisfies the blade arm geometry shown on Fig.201, by utilizing the arm spindle adjustment and the blade attachment fine adjustment.

(9) Repeat wiper blade pressure check (see operation (6)) and if it has changed repeat operation (8) until readings stabilize.

(10) Maintaining the windshield wet, operate the WIPER switch to the SLOW and FAST positions and check for satisfactory operation.

(11) Set WIPER switch to the PARK position; if the wiper arm stops off park position, disconnect the flexible drive at either end and manually rotate the drive until wiper is parked.

NOTE : This manual rotation can be made easier by pulling the arm away from the windshield to relieve the friction load of the wiper blade.

(12) Connect flexible drive. Check parking position. Wire-lock union nuts.

(13) Functionally test windscreen wiper system (para.2.B.).

B. Functionally test windscreen wiper system

(1) Energize the d.c. busbars (see Chapter 24, GENERAL).

(2) CAUTION : DO NOT OPERATE WINDSHIELD WIPERS OVER DRY GLASS.

Wet windscreen. Set the WIPER switch to the FAST position, and check that wiper blade just touches nose skin as it reverses direction. Check that it wipes over desired area.

(3) Simulating rain with a water spray, check for satisfactory clearance at FAST and SLOW speeds.

(4) Set WIPER switch to OFF.

(5) Set WIPER switch to PARK. Check that wiper arm stops in park position.

(6) De-energize the d.c. busbars (see Chapter 24, GENERAL).

3. Inspection/Check

Equipment required :-

0 - 10 lb spring balance

...Windshield wiper system - Maintenance practices continued

A. Check pressure of wiper blade

(1) Pressure of wiper blade against the windshield must be 7 lb ± 1 lb. Check this by hooking a spring balance under the arm at the wiper blade attachment point, and taking a reading as blade commences to lift from glass. If necessary adjust pressure by utilizing wiper arm adjustment nut at actuator arm hub.

(2) CAUTION : DO NOT OPERATE WINDSHIELD WIPER OVER DRY GLASS.

Operate windshield wiper over the windshield (wetted) for 30 seconds and re-check. Re-adjust if necessary and retest.

* * *

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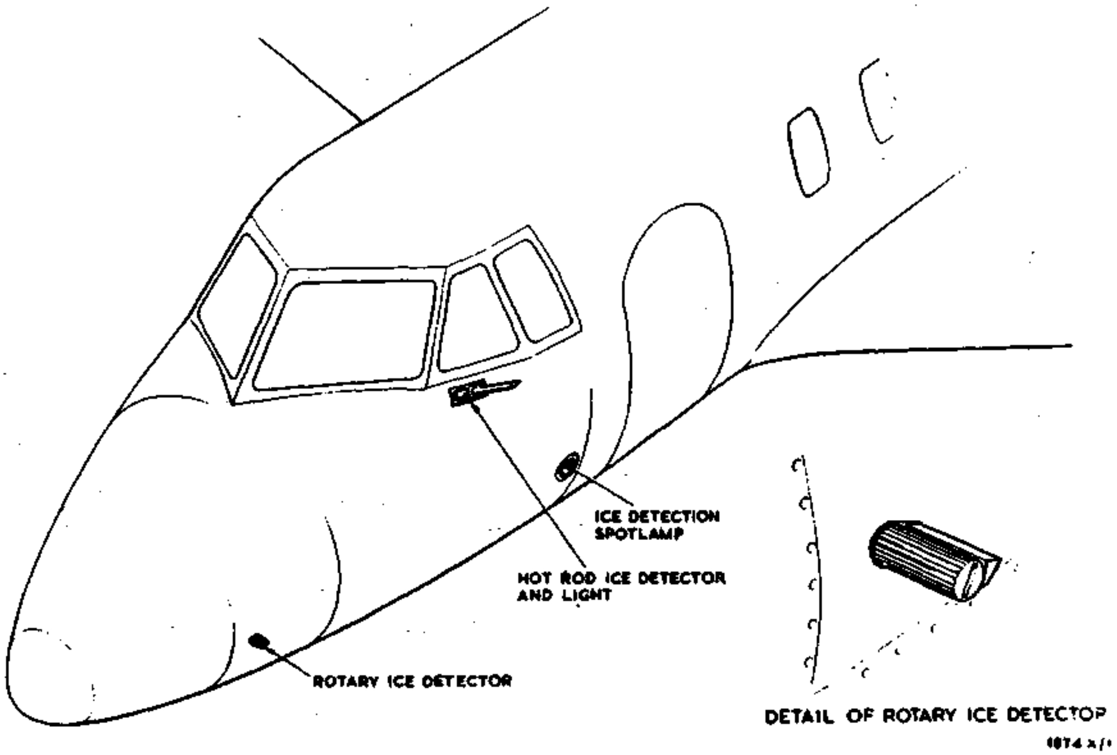
## ICE DETECTION SYSTEM - DESCRIPTION AND OPERATION

### 1. General

A Napier Servomechanism 'rotary' ice detector unit is mounted on the left-hand side of the fuselage nose. A Teddington 'Hot-Rod' ice detector is also fitted when required. A spotlamp, fitted forward of the aircraft entry door, provides illumination of the left-hand wing leading edge for visual inspection of ice accretion.



Ice detection
Fig. 1

The a.c. power for operation of the 'rotary' ice detector is supplied by the main or standby inverter, the related warning lamp obtaining its supply from busbar PE The 'Hot-Rod' ice detector (when fitted) and the spotlamp are supplied from PS busbar.

All the system switches and warning lamps are located on the ICE PROTECTION panel of the flight compartment roof panel. An ice warning from the 'rotary' ice detector also operates the flasher of the central attention system.

### 2. 'Rotary' ice detector

The unit consists of an a.c. - powered motor which drives, through a reduction gearbox, a serrated rotor; the rotor rotates in close proximity to a fixed knife edge cutter. Under icing conditions, ice accretes on the rotor until the gap between the rotor and the cutter is filled. The shaving action of the cutter against the ice causes a rise in motor torque and rotates the motor slightly; this movement operates a toggle bar against its spring tension to actuate a microswitch which connects a d.c. supply to an ICE warning lamp and the flashers of the central attention setting system.

When the icing encounter has passed, a spring returns the motor to the non-icing position and the microswitch open contacts to cancel the warning.

Electrical power supplies are fed through the lever lock microswitch of the left-hand main landing gear; thus, operation of the ice detector is automatic when the weight of the aircraft is taken off the landing gear. An ICE DETection override ON/off switch permits manual selection of the ice detector, if required, for operation on the ground.

## 3. "Hot-Rod" ice detector

This unit (when fitted) is mounted on the left-hand side of the fuselage and is visible through the flight compartment side window. It consists of a rearward-raked vane containing a heating element.

The heating element is normally left OFF so that the severity of ice accretion can be assessed; use of the heater disperses ice to allow further observation.

A lamp enables the vane to be illuminated at night. The ICE IND. switch has three selective positions: LIGHT (up), OFF (centre) and HEAT (down).

## 4. Leading edge inspection lamp

The leading edge spotlamp is controlled by a switch labelled WING. (Refer to Chapter 33, EXTERNAL LIGHTS).

* * *

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# 'ROTARY' ICE DETECTOR - MAINTENANCE PRACTICES

## 1. Removal/Installation

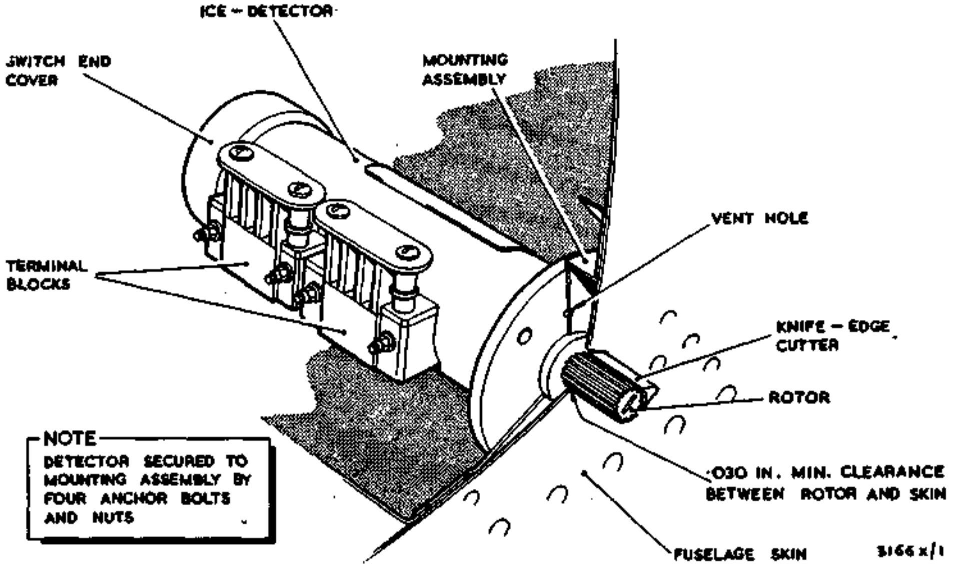
**CAUTION :** DO NOT DISTURB EXTERNAL FIXING BOLTS, NUTS AND SCREWS, OR REMOVE SWITCH END COVER, OR THE ADJUSTMENT OF THE DETECTOR MAY BE SERIOUSLY AFFECTED.

### A. Remove 'rotary' ice detector

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Disconnect electrical cables from detector.

(3) Remove securing nuts and withdraw detector.



NOTE
DETECTOR SECURED TO MOUNTING ASSEMBLY BY FOUR ANCHOR BOLTS AND NUTS

'Rotary' ice detector installation
Fig.201

### B. Install 'rotary ice detector

(1) Ensure that vent holes in ice detector and vent holes and drain hole in mounting assembly are clear. Position ice detector so that vent holes align with vent holes in mounting assembly. Fit attachment nuts and tighten evenly.

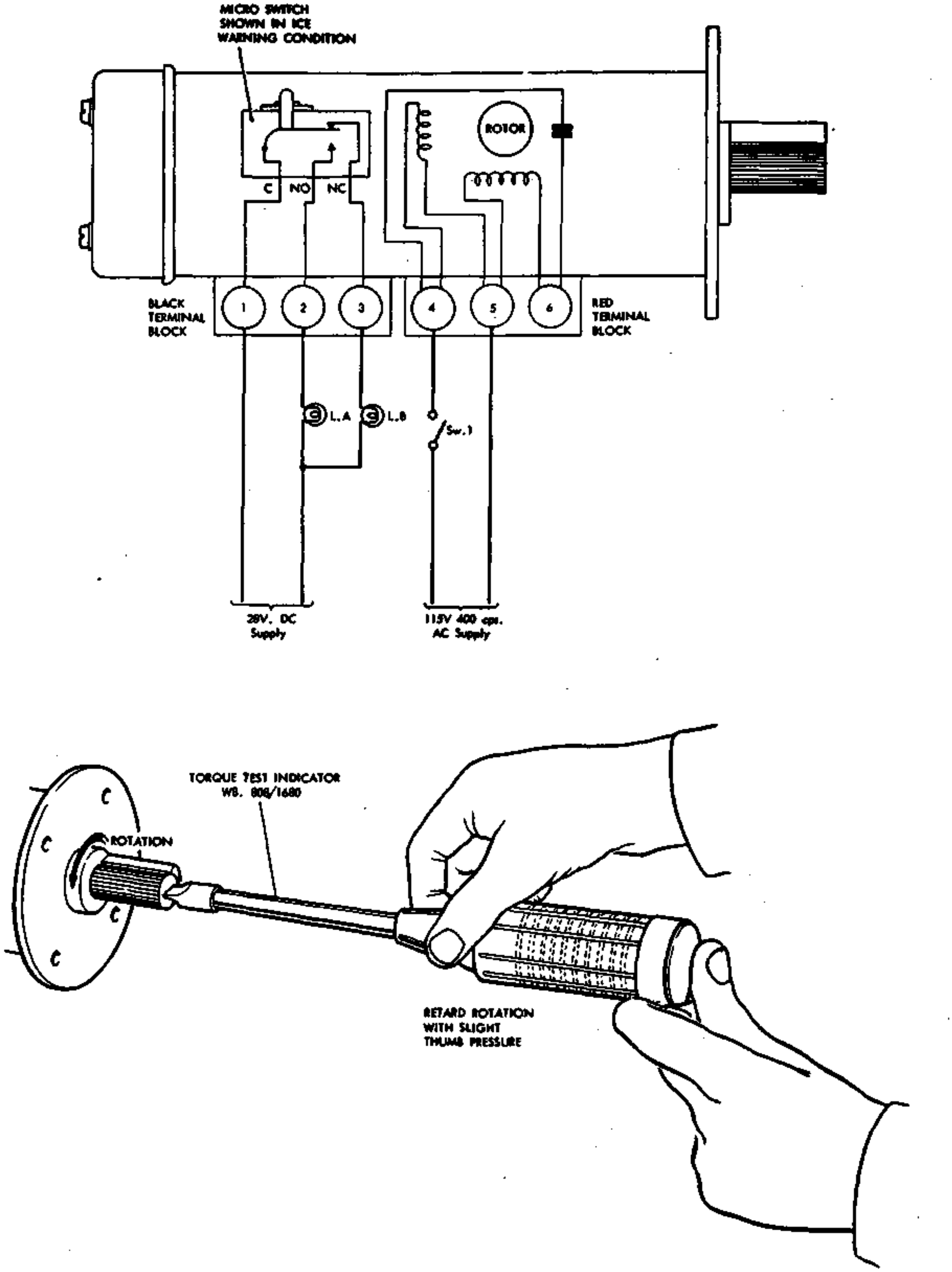
**CAUTION :** DO NOT USE AN AIR JET TO CLEAR VENT HOLES IN ICE DETECTOR AS THIS WILL BLOW FOREIGN MATTER INWARD AND CAUSE DAMAGE TO THE MOTOR.

(2) Check clearance between rotor and skin (Fig.201).

(3) Connect electrical cables to terminal blocks.

(4) Restore electrical supplies.

(5) Functionally test ice detector (para.2).



Ice detector test circuit and wiring diagram
Fig.202

...'Rotary' ice detector - Maintenance practices continued

## 2. Adjustment/Test

Equipment required :-

| | |
|---|---|
| Torque test indicator ... ... ... | Napier WB: 808/1680 |

### A. Functionally test 'rotary' ice detector (on aircraft)

(1) Energize relevant busbars.

(2) Set INVERTER 1 switch to ON.

(3) Set ICE DETection switch to ON.

(4) Check that ice detector serrated shaft rotates in an anti-clockwise direction.

(5) Insert the blade of torque test indicator into slot on the face of the rotor (Fig. 202), and, with slight thumb pressure, apply a torque load. Check that ICE warning lamp and the flasher of the central warning system light.

NOTE : The ice detection system should energize before sufficient torque is applied to cause motor in the detector to labour.

(6) Release torque load. Check that warning lamps go out after approximately 30 sec. delay. Cancel CAGS flashers.

(7) Set ICE DETection switch to off.

(8) Depress leg lock microswitch (lower torque link, left main landing gear) and check that ice detector serrated shaft rotates in an anti-clockwise direction.

(9) Set INVERTER 1 switch to OFF.

(10) De-energize relevant busbars.

### B. Functionally test 'rotary' ice detector (on bench)

(1) Connect detector in a test circuit as shown on Fig. 202.

(2) Close SW. 1, and check that lamp A is on, and lamp B is off.

(3) Insert the blade of torque test indicator in the slot on the face of the rotor (Fig. 202) and apply a slight thumb pressure torque until lamps A and B change over.

NOTE : The lamps should change over before sufficient torque is applied to cause the motor in the detector to labour.

(4) Open SW. 1, and remove the detector from the test circuit.

* * *

# 'HOT ROD' ICE DETECTOR - MAINTENANCE PRACTICES

## 1. Adjustment/Test

### A. Functionally test 'hot-rod' ice detector

(1) Energize relevant busbar (see Chapter 24, GENERAL).

(2) Set ICE IND switch to LIGHT. Check that vane inspection lamp lights. Set switch to OFF, check that lamp goes out.

(3) CAUTION : DURING THIS TEST, THE ICE IND SWITCH MUST NOT BE SET TO HEAT FOR PERIODS GREATER THAN 10 SECONDS.

Set ICE IND switch to HEAT; feel that vane commences to get warm. Set switch to OFF; feel that vane cools.

(4) De-energize busbar.

## 2. Cleaning/Painting

### A. Clean 'hot-rod' ice detector window

(1) Should the window be discoloured or dirty it may be cleaned with soap and water.

(2) If the window has been masked for any reason, no attempt must be made to remove the masking material by applying thinners or trichloroethane.

* * *

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## TIME DELAY RELAY - MAINTENANCE PRACTICES

### 1. Adjustment/Test

Should it become necessary to fit a new time delay relay, the new item will have to be tested and adjusted for the correct time interval delay of 30 seconds.

### A. Adjust time delay relay

Equipment required :

A 28V d.c. supply, two single pole switches; two 28V 3.5W lamps, stop watch.

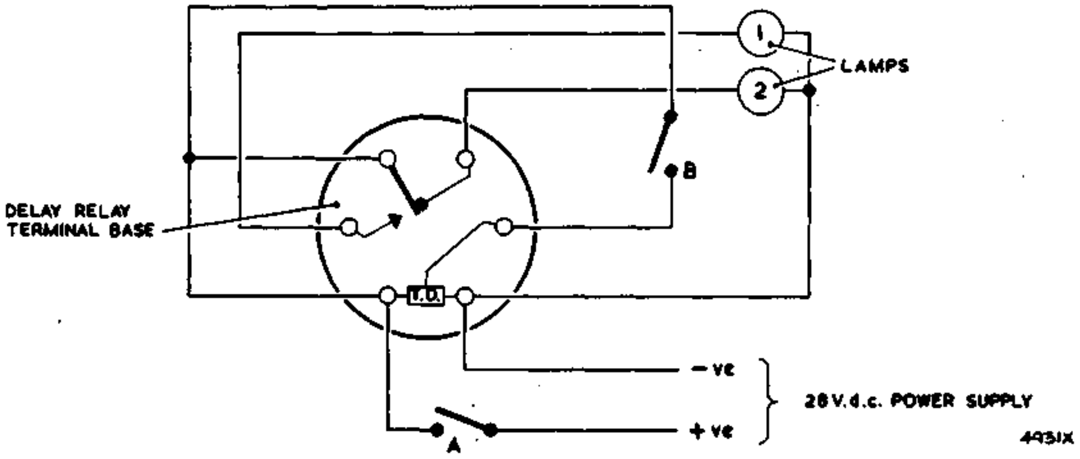
(1) Assemble the relay and equipment into the test circuit as shown in Fig.201.

(2) Switch on the power supply (switch A) and check that the relay 'normally closed' contact is routing a supply to lamp 2.

(3) Switch on the control supply (switch B) and check that the relay changes over and the supply is now routed to lamp 1.

(4) Switch off the control supply and at the same time start the stop watch. When lamp 1 goes off and lamp 2 comes on, stop the stop watch and note the time delay of the relay.

(5) Adjust the adjusting screw at the rear of the relay to increase or decrease the time delay as required and repeat operations (3) and (4) until the correct delay of thirty seconds is achieved.



Time delay relay test circuit
Fig.201

* * *

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# CHAPTER

# 31

# INDICATING/ RECORDING SYSTEMS

# Chapter 31

# INSTRUMENTS

## TABLE OF CONTENTS

31-01 INSTRUMENT PANELS - GENERAL

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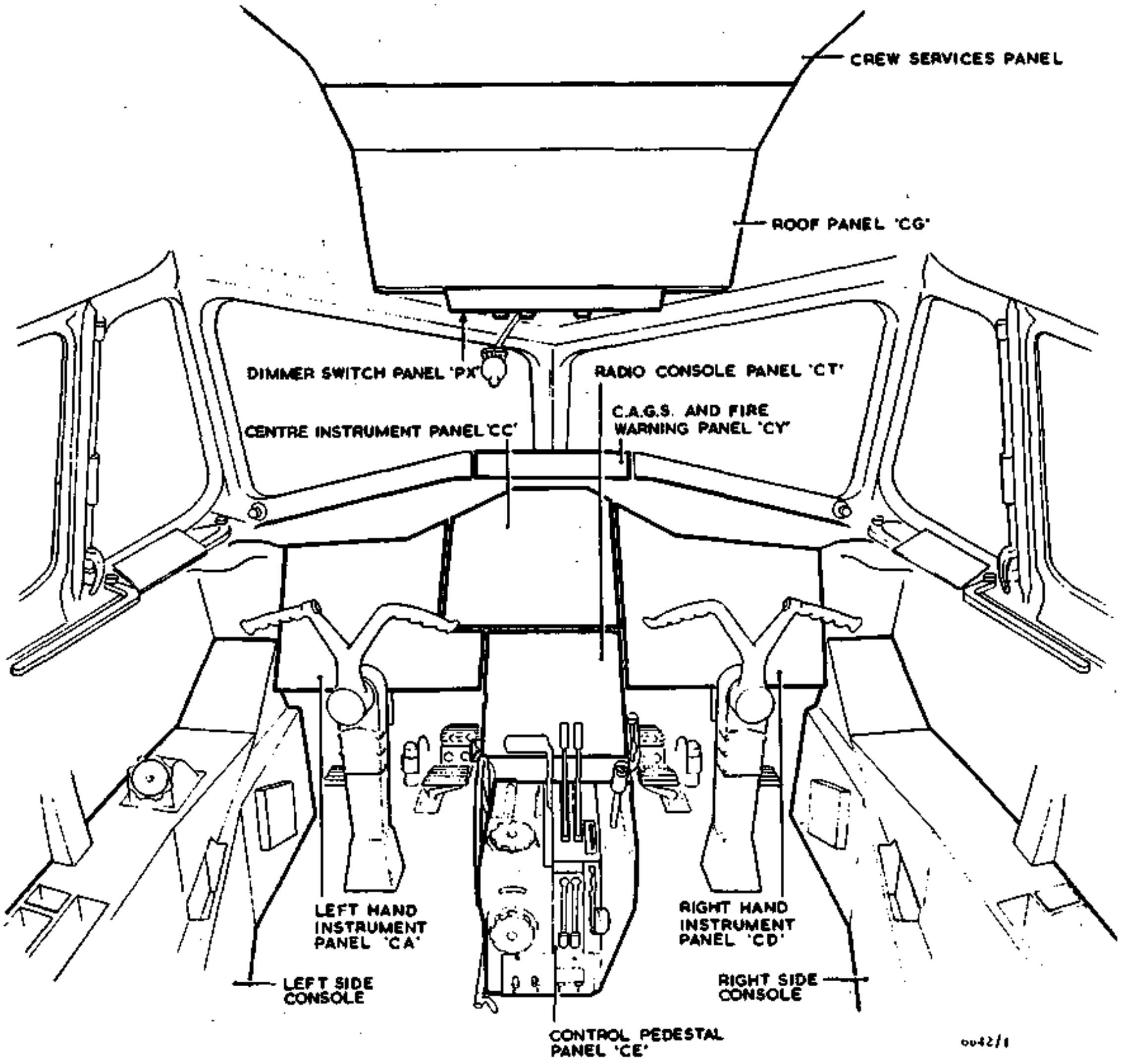
## INSTRUMENT PANELS - GENERAL

### 1. General

The pilots' instrument panels (Fig.1) comprise left, centre and right main panels, a roof switch panel, a crew services panel and left and right main consoles. The panels and consoles are of aluminium alloy sheeting with a matt crinkle stove enamel finish. The main instrument panels are surmounted by a coaming, triangular in shape, secured to pick-up brackets disposed around the canopy lower rail.


CREW SERVICES PANEL
ROOF PANEL 'CG'
DIMMER SWITCH PANEL 'PX'
RADIO CONSOLE PANEL 'CT'
C.A.G.S. AND FIRE WARNING PANEL 'CY'
CENTRE INSTRUMENT PANEL 'CC'
LEFT HAND INSTRUMENT PANEL 'CA'
RIGHT HAND INSTRUMENT PANEL 'CD'
LEFT SIDE CONSOLE
RIGHT SIDE CONSOLE
CONTROL PEDESTAL PANEL 'CE'
0042/1

Instrument panel layout - general
Fig.1

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2. Main panels

A tubular support is attached at each end to lugs fitted to the canopy lower rail; rigidity is imparted centrally to the support by a link assembly also attached to the canopy lower rail. Brackets welded to the support provide anchorages for the centre and right main panels. Additional brackets at each outboard end of the canopy rail and on frame 2 provide further attachment points for the left and right main panels.

A radio controller mounting box assembly, fastened at its lower edge to the pilots' control pedestal structure, is secured at its top edge to a radar indicator support channel, riveted to the front pressure bulkhead, and to the lower edge of the centre main instrument panel. This box structure incorporates bearing plates on each side panel on which hinge arms welded to the inboard edges of the left and right main instrument panels pivot about special pivot bolt assemblies. Hinge arms at the outboard edges of these panels are secured to bearing plate and pivot bolt assemblies at frame 2. When hinged down, the panels are supported by retaining cables secured to the front pressure bulkhead.

The configuration of the left and centre main instrument panels is such as to allow the fitting of a weather radar display indicator. Furthermore, the centre panel has two vertical slots on the right-hand side through which pass the landing gear selector and trip levers.

3. Side consoles

The side consoles extend from frames 2 to 7 and consist of a top panel and side fairing. The top panel is secured to support brackets attached to the fuselage frames, and the side fairings are attached to the top panel, side and floor supports by Camloc fasteners.

4. Coaming

Pre modification 252071 and 252073 (pre aircraft construction No. 25211) :-
The coaming is fabricated from aluminium alloy, its rear edge being flanged to provide a mounting base for the central attention getting and fire warning and extinguisher systems panel, leather-covered foam rubber protection padding and the main instrument panels lamps; the latter are mounted on fabricated glass fibre laminated strips and are held in position by the protection padding securing bolts. The coaming is finished matt black except for the area immediately surrounding the lamps, which is painted white to provide a light reflecting surface.

Modification 252071 and 252073 (aircraft construction Nos. 25211 and subsequent):-
The coaming is fabricated from aluminium alloy, its rear edge being flanged to provide a mounting base for the central attention getting system panel, leather-covered foam rubber protection padding and the main instrument panels lamps; the latter are mounted on fabricated glass fibre strips. The coaming around the lights is painted white to provide a reflecting surface.

5. Roof switch panel

The roof switch panel is hinged at its lower edge and secured at its top edge to brackets attached to the roof support members. This panel employs Thorn Plasteck lighting, whereby a number of miniature lamps disposed at selected positions on the panel are used to diffuse light through transparent plastic. This latter is faced on its upper

...Instrument panels - General continued

and lower surfaces with translucent white plastic and has a further overlay of grey plastic on its upper surface. Lettering on the panel is engraved through the grey plastic to expose the underlying white layer. This arrangement provides easily discernible lettering during normal daylight conditions and, when the Plasteck lighting is utilized, the light filters through the white plastic to give an illuminated address. Instrument dials are illuminated through facets in the plastic surface surrounds. A typical arrangement is shown on Fig.2.

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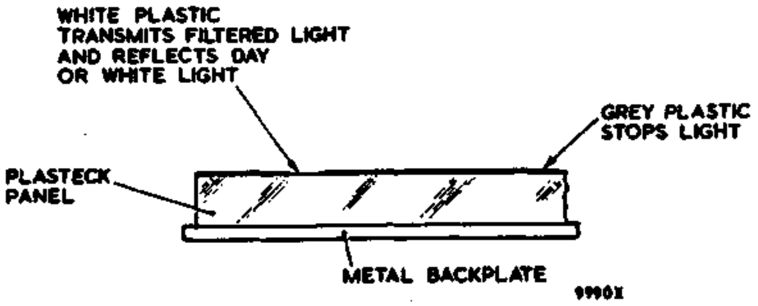
WHITE PLASTIC TRANSMITS FILTERED LIGHT AND REFLECTS DAY OR WHITE LIGHT
GREY PLASTIC STOPS LIGHT
PLASTECK PANEL
METAL BACKPLATE
9990X

Plasteck panel arrangement
Fig.2

## 6. Crew services panel

The crew services panel is secured to the roof support members by bolts. This panel contains the loud speaker and associated switch, two chart lights and associated dimmer switches, two switches controlling the pad lights and two louvres.

* * *

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## INSTRUMENT PANELS - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove left and right main instrument panels

(1) Isolate the relevant electrical circuits (Chapter 24,GENERAL).

(2) Remove radio controllers as necessary to gain access to pivot bolts.

(3) Disconnect electrical leads.

(4) Disconnect pitot/static pipelines and blank off all exposed orifices.

(5) Support instrument panel and release cable supports.

(6) Withdraw pivot bolts and remove panel.

#### B. Install left and right main instrument panels

(1) Offer up panel and locate hinge arms on bearing plates with pivot bolt assemblies, tighten stiffnuts.

(2) Attach cable supports to panel, tighten stiffnut.

(3) Connect electrical leads.

(4) Remove blanks from pitot/static pipes and blow clean dry air through pipes to ensure freedom from obstruction.

(5) Connect pitot/static pipes; tighten and wirelock unions.

(6) Raise and secure panel.

(7) Fit and connect radio controllers.

(8) Effect pressure and suction tests on the pitot/static system (see Chapter 34, PITOT/STATIC SYSTEM).

(9) Restore the relevant electrical supplies (Chapter 24,GENERAL).

(10) Functionally test electrical and radio services disturbed during panel removal.

#### C. Remove centre instrument panel

(1) Isolate the relevant electrical circuits (Chapter 24, GENERAL)

(2) Remove landing gear selector lever knob.

(3) Remove bolts securing lower edge of panel to radio controllers mounting box.

(4) Support panel and release top edge securing bolts.

(5) Disconnect electrical leads.

## D. Install centre instrument panel

(1) Connect electrical leads to relevant instruments.

(2) Locate panel in position and secure at top edge.

(3) Fit landing gear selector lever knob.

(4) Secure lower edge of panel to radio controllers mounting box.

(5) Restore the relevant electrical supplies (Chapter 24, GENERAL).

(6) Functionally test the instruments within their relevant systems.

## E. Remove instrument panel coaming

(1) Isolate the relevant electrical circuits (Chapter 24, GENERAL).

(2) Remove as necessary components located on the coaming and unscrew coaming securing bolts.

(3) Lower right main instrument panel and release coaming electrical services connector.

(4) Withdraw coaming panel.

## F. Install instrument panel coaming

(1) Locate and secure coaming, using bolts.

(2) Connect and secure coaming electrical services connector.

(3) Locate, secure and connect components on coaming.

(4) Raise and secure right main instrument panel.

(5) Restore relevant electrical supplies.

(6) Functionally test coaming electrical services.

continued on following page

G. Remove console side panels

(1) Release the Camloc fasteners and remove side panels.

H. Install console side panels

(1) Locate side panels on consoles and secure Camloc fasteners.

I. Remove roof Plasteck panel

(1) Isolate the relevant electrical circuits (see Chapter 24, GENERAL).

(2) Release roof panel securing screws and lower roof panel onto cable supports.

(3) Disconnect leads to Plasteck panel assembly from terminal block(s).

(4) If applicable remove cabin temperature control knob.

(5) Release Plasteck panel securing screws and remove panel. Protect front face of panel from damage whilst in transit or storage.

J. Renew filament (Modification 25/6077)

Materials required :-

| | | | |
|---|---|---|---|
| Lamp mounting pad | ... | ... | Thorn Electrical Component 01-0628 |
| Adhesive | ... | ... | Raychem Adhesive S1005 (two part) |
| Solder | ... | ... | 16 s.w.g. to BS141 or DTD599 |
| Sealing strip | ... | ... | Industrial Sealants Inseal 300 or 375 |
| Paint (black) | ... | ... | Pax 1G28 |
| (white) | ... | ... | Pax 1G29 |
| (grey) | ... | ... | Pax 1G48 |
| Cleaning fluid | ... | ... | White spirit |

NOTE : Carry out the following operations on a suitable work surface to prevent damage to Plasteck panel face.

(1) Remove captive securing screws and washers by unscrewing through the captive bushes (see Fig.201,Detail A).

(2) Unscrew and remove captive bushes using the slots provided (see Fig.201, Detail B).

(3) Where applicable, remove retaining screws and remove captive securing screws by unscrewing through the insulation bushes (see Fig.201, Detail C).

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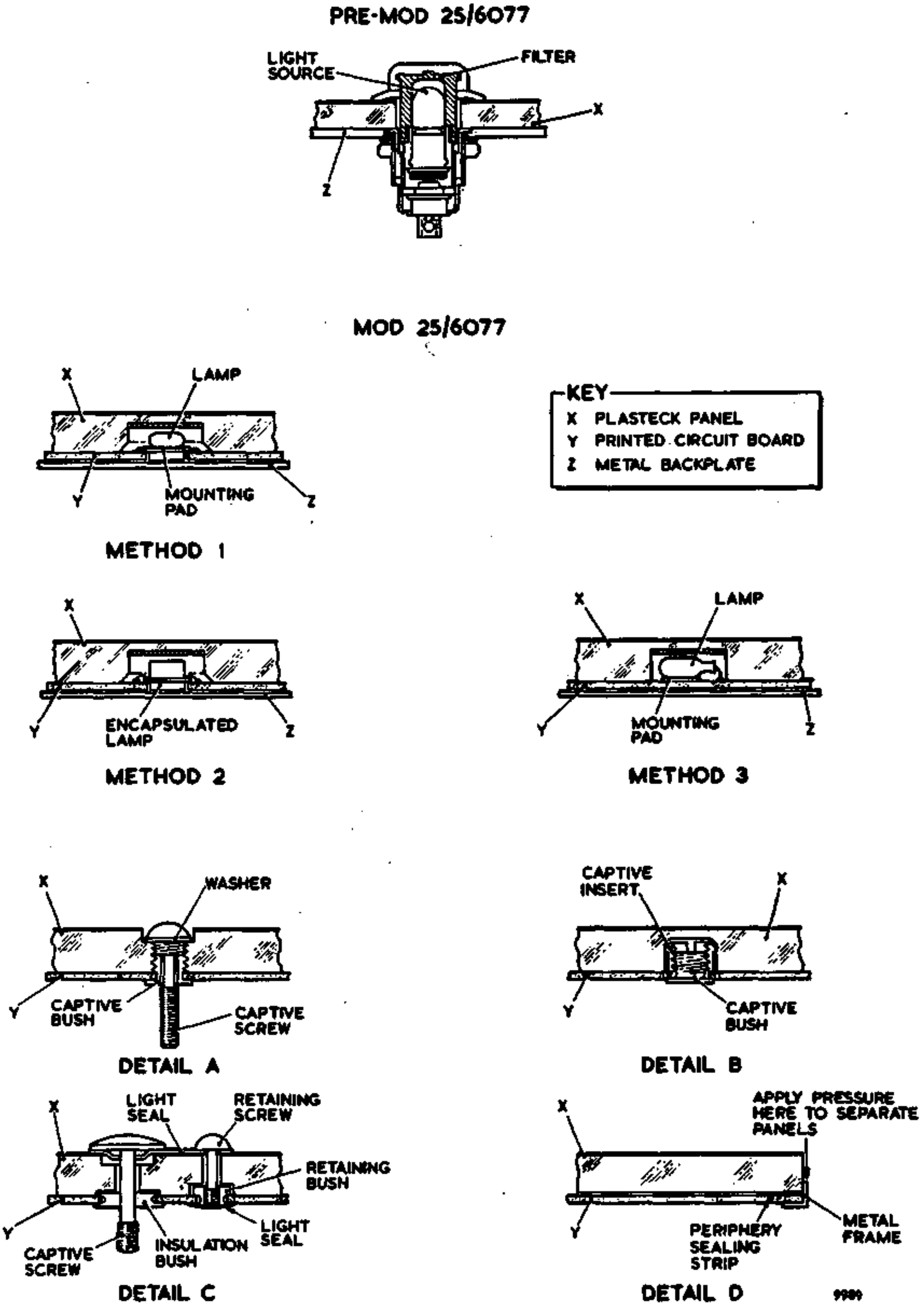
...Instrument panels - Maintenance practices continued



Plasteck panel - details
Fig.201

...Instrument panels - Maintenance practices continued

(4) Gently depress metal frame at the outer edges of the rear of panel evenly around and away from Plasteck panel, until part of sealing strip coloured grey is visible. Using a sharp, thin bladed instrument, slit the sealing strip around the periphery of the panel. Remove the printed circuit board with metal frame attached (see Fig.201, Detail D)

(5) Remove periphery sealing strip from Plasteck panel using cleaning fluid as necessary. Wash Plasteck panel in warm soapy water, rinse and dry; place aside.

(6) Locate faulty lamp(s), unsolder lamp leads, or capsule tags, as applicable.

(7) Remove faulty lamp(s) complete with mounting pad or capsule(s).

(8) Remove remnants of periphery sealing strip using cleaning fluid as necessary.

(9) Refit the non-encapsulated lamp(s) by carrying out the following procedure :-

(a) Position the lamp mounting pad centrally between the solder connections and two locating holes on printed circuit board.

(b) Cut lamp leads to 5/16 in. or 8.0 mm.

(c) Position lamp horizontally on mounting pad with leads on solder connections and tip of lamp between locating holes. Solder lamp lead to printed circuit using recommended solder.

(d) Lift lamp slightly and apply a small quantity of adhesive to mounting pad. Replace lamp by pressing down onto adhesive. Allow adhesive to cure for 4 hours at 60°C.

(10) Refit encapsulated lamp(s) by positioning assembly in printed circuit hole with tags aligned with printed circuit. Solder encapsulated lamp tags to printed circuit using recommended solder.

(11) Check printed circuit board flying leads for security, replace if necessary taking care to maintain identification.

(12) Cut sealing strip to lengths to suit inside of printed circuit board frame, remove backing strip and attach to printed circuit board.

(13) Place Plasteck panel face down on work surface and position printed circuit board on the back face of Plasteck panel.

(14) Secure printed circuit board to Plasteck panel with captive bushes.

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(15) Fit captive securing screws to Plasteck panel assembly ensuring that washers are correctly positioned (see Fig.201, Detail B).

(16) Where applicable fit captive securing screws through insulation bush, position light seal, fit and secure retaining screws (see Fig.201, Detail C).

K. Install roof Plasteck panel

(1) Position Plasteck panel ensuring that printed circuit board connecting leads are not trapped and secure captive screws.

(2) If applicable, fit cabin temperature control knob.

(3) Connect leads from Plasteck panel assembly to terminal block(s).

(4) Raise and secure roof panel assembly.

(5) Restore relevant electrical circuits.

(6) Functionally test roof panel lighting.

* * *

# CHAPTER

# 32

# LANDING GEAR

# CHAPTER 32

# LANDING GEAR

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| | 506 | Dec.99 |
| | 601 | Dec.99 |
| 32-10-32 | 201 | Apr.81 |
| | 202 | Apr.81(GE) |

| CH-SE-SU | PAGE | DATE |
|---|---|---|
| 32-10-41 | 201 | Aug.93(G) |
| | 202 | Aug.93(G) |
| | 203 | Aug.93(W) |
| | 204 | Aug.93(G) |
| | 205 | Aug.93(G) |
| | 206 | Aug.93(G) |
| | 207 | Aug.93(W) |
| 32-20 | 1 | Oct.91(G) |
| | 2 | Jan.31/64 |
| | 3 | Oct.91(G) |
| 32-20-12 | 201 | Sept.98 |
| | 202 | Sept.98 |
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| | 207 | Sept.98 |
| 32-20-21 | 201 | Dec.99 |
| | 202 | Dec.99 |
| | 203 | Dec.99 |
| | 204 | Dec.99 |
| 32-20-41 | 201 | Apr.77 |
| | 202 | Oct.71(W) |
| 32-30-01 | 1 | Sept.81 |
| | 2 | Sept.81 |
| | 3 | Sept.81 |
| | 4 | Apr.81 |
| | 5 | Sept.81(W) |
| | 201 | Sept.81 |
| | 202 | Sept.81 |
| 32-30-05 | 401 | Dec.99 |
| | 402 | Dec.99 |
| 32-30-11 | 501 | Sept.98 |
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| | 503 | Sept.98 |
| | 504 | Sept.98 |
| 32-30-21 | 201 | Sept.30/65 (DH.18) |
| | 202 | Apr.67 |

| CH-SE-SU | PAGE | DATE |
|---|---|---|
| 32-30-26 | 201 | June 79 |
| | 202 | Sept.78 |
| | 203 | Sept.78 |
| | 204 | June 79 |
| 32-30-31 | 1 | June 67 |
| | 2 | June 67 |
| | 3 | June 67 |
| | 201 | Jul.86(H) |
| | 202 | Jul.86(H) |
| 32-30-41 | 201 | Oct.71 |
| | 202 | Oct.71 |
| 32-40 | 1 | Nov.30/64 (Z-DH.8) |
| | 2 | Dec.72(Y) |
| | 3 | Nov.30/64 (Z-DH.8) |
| | 4 | Jan.31/64 |
| | 201 | Apr.77(G) |
| | 202 | Apr.77 |
| | 203 | Sept.78(Y) |
| | 204 | Sept.78(Y) |
| | 205 | Sept.92(GG) |
| 32-40-11 | 301 | Dec.99 |
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| | 402 | Dec.99 |
| | 403 | Dec.99 |
| | 601 | Dec.99 |
| | 701 | Dec.99 |
| | 801 | Dec.99 |
| 32-40-21 | 301 | Dec.99 |
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| | 402 | Dec.99 |
| | 701 | Dec.99 |
| | 801 | Dec.99 |
| 32-40-31 | 401 | May 95 |
| | 402 | May 95 |
| | 403 | May 95 |
| 32-40-41 | 1 | Dec.99 |
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| | 3 | Dec.99 |
| | 4 | Dec.99 |
| | 401 | Dec.99 |
| | 601 | Dec.99 |
| 32-40-41 | 602 | Dec.99 |
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| | 609 | Dec.99 |
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| | 202 | June 78 |
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| | 204 | June 78 |
| | 205 | Apr.93(GX) |
| | 206 | Sept.92(GX) |
| | 207 | Sept.92(GX) |
| 32-40-61 | 101 | Jan.31/64 |
| 32-40-71 | 101 | Jan.31/64 |
| | 401 | Dec.99 |
| | 402 | Dec.99 |
| | 403 | Dec.99 |
| | 404 | Dec.99 |
| 32-40-91 | 101 | Jan.31/64 |
| | 201 | Apr.77 |
| 32-40-101 | 101 | May 95 |
| | 102 | May 95 |
| | 103 | May 95 |
| | 201 | July 83(G) |
| | 202 | July 83(G) |
| | 203 | July 83(G) |
| | 204 | July 83(G) |
| | 205 | July 83(GY) |
| 32-40-112 | 101 | Nov.30/64(DH.8) |
| | 301 | Jun.03 |
| | 302 | Jun.03 |
| | 303 | Jun.03 |
| | 304 | Jun.03 |
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| | 402 | Jun.03 |
| | 403 | Jun.03 |

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| 32-40-112 Cont. | 601 | Jun.03 |
| | 602 | Jun.03 |
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| | 402 | Dec.99 |
| 32-50-12 | 401 | Dec.99 |
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| | 203 | Sept.78(GY) |
| | 204 | Sept.78(GY) |
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| | 503 | Jun.03 |
| 32-65-00 | 1 | Sept.98 |
| | 201 | Sept.98 |
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| | 203 | Sept.98 |
| | 204 | Sept.98 |

# LANDING GEAR - DESCRIPTION

**WARNING: WHEN AN AIRPLANE HAS EXPERIENCED ABNORMAL OR EMERGENCY LANDING GEAR PROCEDURES OF ANY TYPE, INCLUDING AN UNSAFE LANDING GEAR INDICATION OR EMERGENCY EXTENSION OF THE LANDING GEAR, PLACE THE AIRPLANE ON JACKS (AMM 7-10-00) BEFORE PERFORMING ANY INSPECTION OR MAINTENANCE.**

**WARNING: MAKE SURE THAT ALL THREE LANDING GEARS ARE DOWN AND LOCKED BEFORE REMOVING THE AIRPLANE FROM JACKS (AMM 7-10-00).**

## 1. General

The retractable landing gear consists of a nose gear and two main gear units, each unit embodying an oleo-pneumatic shock absorber strut and twin wheels. Hydraulic jacks, one on each unit, retract the main gear inward into wells in the wing and the nose gear forward into a nose gear bay. Power for operating the retraction jacks is normally provided by the main hydraulic system; an independent auxiliary hydraulic system, operated from a handpump in the flight compartment, is provided for emergency lowering of the gear.

The nosewheel is self-centring and steerable from a handwheel in the flight compartment. Hydraulic brakes on the main wheels, normally operating from the main hydraulic system through anti-skid units, are controlled by toe-operated master cylinders. Pressure obtained from the emergency brakes accumulator is used for parking and for emergency wheel brakes operation. In the latter case, the anti-skid units are by-passed.

When the landing gear is retracted, the nose gear is fully enclosed by two doors, hinged one on each side of the nose gear bay. The main gear is faired, in the retracted position, by hinged fairings which cover the legs only, and by a hydraulically-operated door which covers the main gear wheels, thus totally enclosing the retracted gear. The nose gear doors and main gear leg-fairings are mechanically linked to their respective retraction mechanisms.

Annunciators in the flight compartment are connected to microswitches operated by the main and nose gear units. In addition, mechanical indicators connected to the retraction mechanism of each unit provide visual indication of the gear position.

# LANDING GEAR - MAINTENANCE PRACTICES

**WARNING: (AIRPLANES WHICH ARE PRE MOD.252440 ONLY) WHEN THE HYDRAULIC PRESSURE IS RELEASED, THE HYDRAULICALLY-OPERATED DOORS MAY DROOP. IF THE SYSTEM IS SUBSEQUENTLY PRESSURIZED BY MEANS OF AN EXTERNAL RIG OR BY THE ENGINES THE DOORS WILL RETURN SMARTLY TO THE CLOSED POSITION. AS A SAFEGUARD TO PERSONNEL WORKING ON OR IN THE VICINITY OF THE MAIN GEARS, WHEN SYSTEM PRESSURIZATION BY EITHER OF THE ABOVE MEANS IS LIABLE TO OCCUR, IT IS RECOMMENDED THAT SPECIAL CLAMP (25Y1491-A) BE INSTALLED TO THE DOOR JACKS TO RETAIN THE DOORS IN THE OPEN POSITION. REFER TO RELEVANT MAINTENANCE PRACTICES**

# MAIN GEAR, FAIRINGS AND DOORS - DESCRIPTION AND OPERATION

## 1. Description (Fig.1)

Each main gear leg assembly incorporates an oleo-pneumatic shock absorber strut, at the base of which are mounted the two offset axle tubes. The complete leg assembly is supported in trunnion bearings on a fitting extending aft from the wing rear spar, and stabilized, when in the down position, by a side stay between the leg and the wing structure.

The side stay folds during retraction and forms the main locking component when the gear is in both the extended and retracted position.

The gear leg is faired in the up position by a fairing which is hinged to the lower wing skin and linked to the leg by a short strut.

The wheel well is covered by a faired door which closes after both extension and retraction.

## 2. Operation (Fig.2)

### A. Retraction

With the landing gear down, the stop bolt on the side stay upper arm contacts the stop face on the lower arm, the locking pin is held against one end of the locking slot and the roller is engaged on the end face of the cam on the lower arm. In this position, the pivot point of the side stay is over-centre in relation to the upper and lower side stay connections, so forming a geometric lock; opposition to unlocking of the roller lever is provided by an over-centre condition at the short link.

When the landing gear is selected up, the first movement of the jack body moves the link forging against the loading of the spring strut. This operates the locking lever which, through the short link, disengages the roller from the end face of the cam on the lower arm; at the same time the locking pin is moved to the other end of the locking slot. Further movement of the jack causes the side stay to fold and the leg is retracted by the force applied to the retraction lever at the leg.

When retraction is nearly completed, the side stay straightens again, being pulled into position by the leg. Due to the rotation of the link forging, the final movement of the jack moves the locking pin to the 'locked' end of the slot and operates the locking lever to engage the roller on the end face of the lower arm. The side stay components are now in the same relative position as when the gear is locked down; the spring strut ensures that the lock is maintained if hydraulic pressure is removed from the jack.

During retraction of the main gear, linkages operate a sequence valve and a reversing valve to control the opening and closing of the wheel doors.

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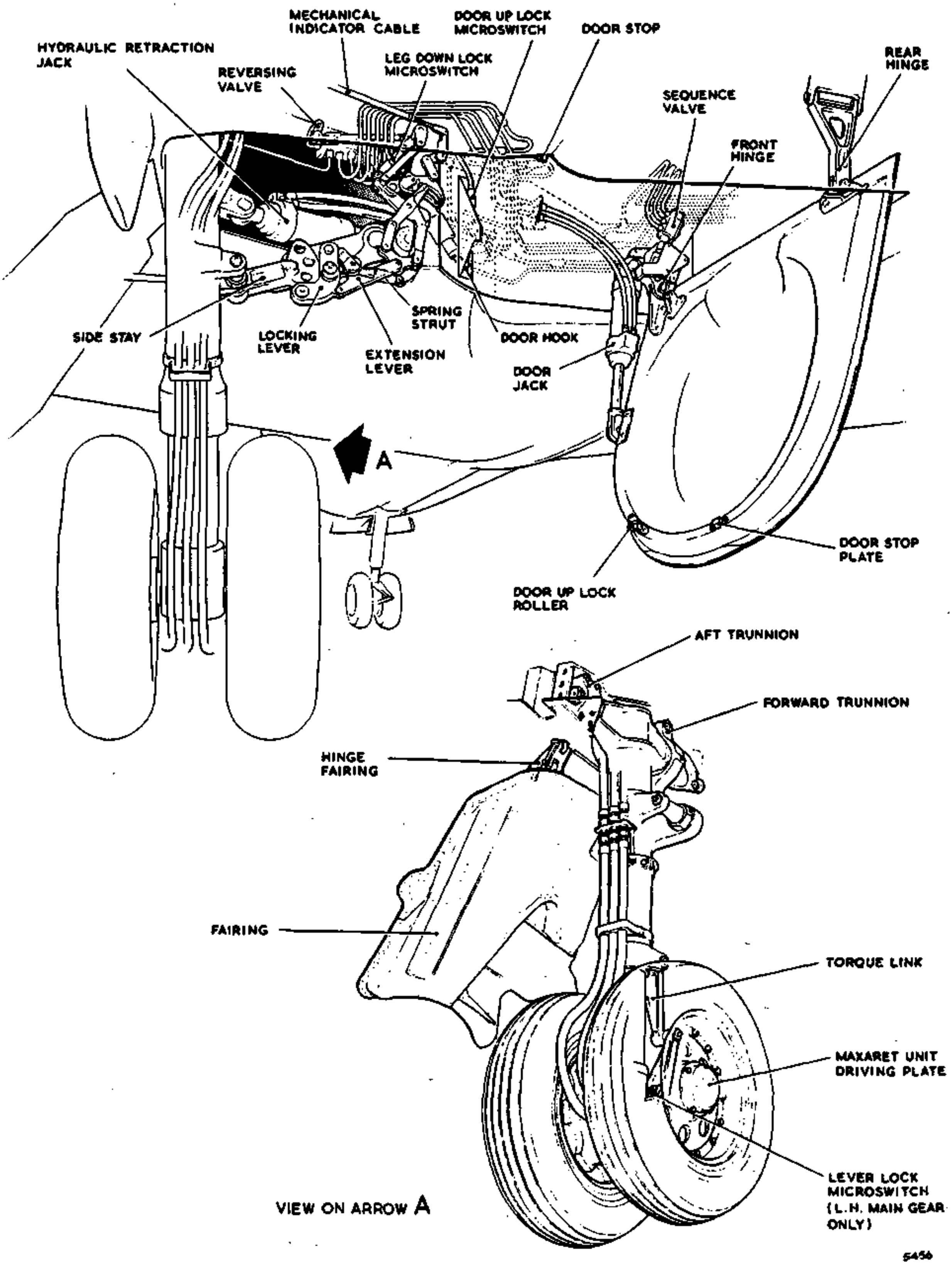

Main landing gear
Fig.1

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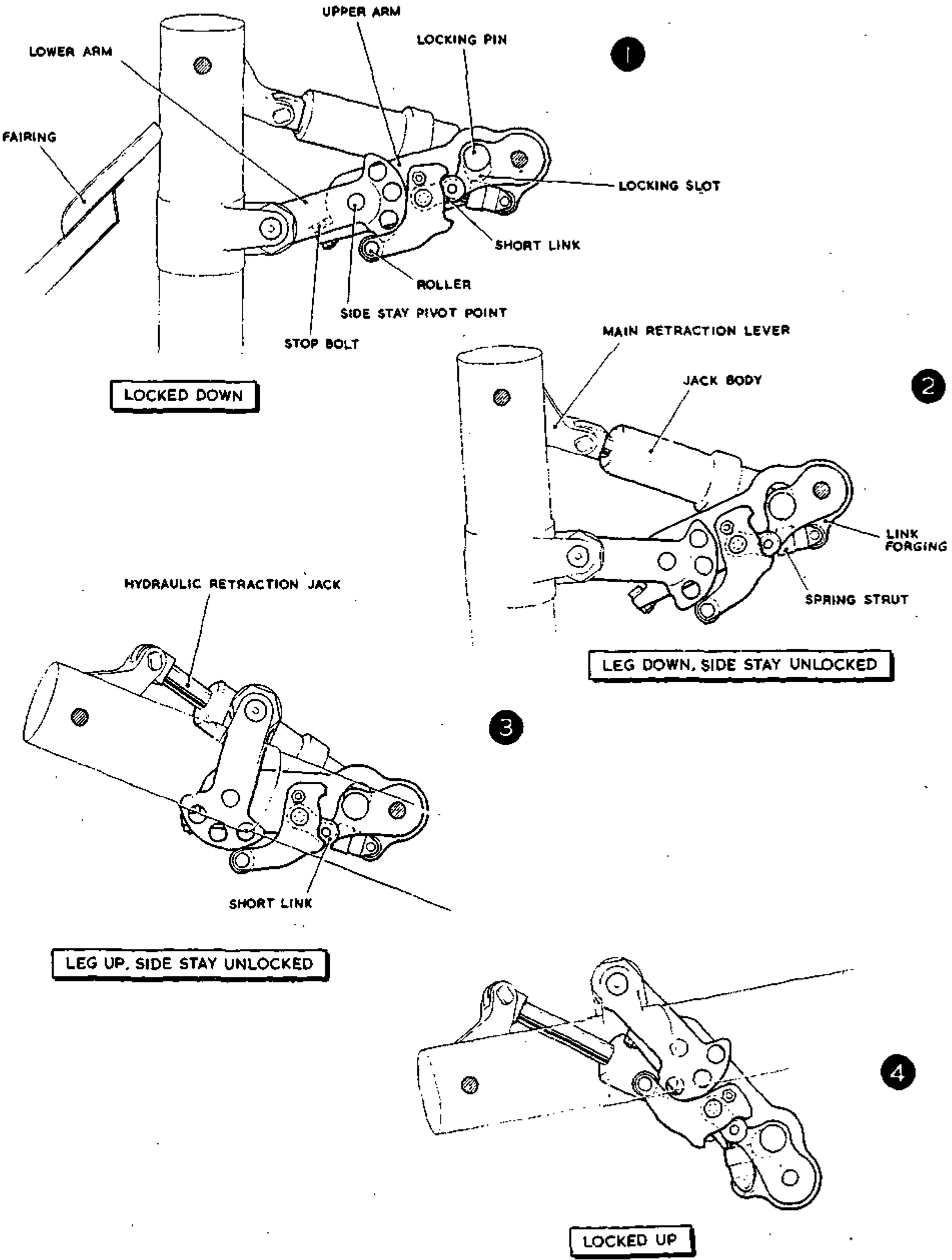


LOCKED DOWN

LEG DOWN, SIDE STAY UNLOCKED

LEG UP, SIDE STAY UNLOCKED

LOCKED UP

5645

Main gear retraction sequence
Fig.2

B. Extension

The extension sequence is the reverse of retraction. The jack retracts, rotates the locking lever, the locking pin moves in the slot, the roller moves from the cam face and the lock is broken. The gear extends, the side stay folds and then straightens, the locking lever is rotated, the locking pin moves in the slot, the roller engages and the down lock is made.

* * *

# MAIN LEG ASSEMBLY - MAINTENANCE PRACTICES

## 1. Unit servicing

### A. Lubrication

For routine lubrication data, refer to the Maintenance Schedule.

### B. Check nitrogen pressure in leg

Refer to Chapter 12, SERVICING - LANDING GEAR.

### C. Fill leg with hydraulic fluid (airplane not on jacks)

| Equipment/Material | Part/Item No. |
|---|---|
| Adapter | 25Y759A |
| Hydraulic fluid | 107 (Chapter 20-95-101) |
| Silicone grease | 046 (Chapter 20-95-11) |
| Clamp | 25Y1491-31A |

(1) Install gear locking pins.

(2) Protect wheels and tires from spilt fluid.

(3) Lower the gear door and install the actuator clamp

**WARNING: BE CAREFUL WHEN RELEASING PRESSURIZED NITROGEN FROM THE LEG. RELEASE THE PRESSURE SLOWLY, A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY. PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.**

**CAUTION: FAILURE TO RELEASE THE PRESSURE SLOWLY MAY RESULT IN DAMAGE TO THE SHOCK ABSORBER STRUT INTERNAL STOPS.**

(4) Slowly release the nitrogen pressure from the leg through the charging adapter and make sure the shock absorber strut is fully bottomed.

(5) Remove the locking plate and then unscrew and remove the nitrogen charging valve from the shock absorber strut.

(6) Get access to the bleed screws at the top of the leg. Remove one bleed screw and connect the pump adapter in its place.

(7) Remove the remaining bleed screw and in its place, suitably attach a length of tubing. Lead the free end of the tube into a clean oil container.

(8) Pump in hydraulic fluid (Item 107) until all gas is expelled and there is a gas-free flow of fluid from the tubing.

# TEMPORARY REVISION 32-4

## REASON FOR ISSUE

To introduce main landing gear trunnion bolt torque values.

## ACTION

In place of Chapter 32-10-11 page block 201, Paragraph 2. Removal/Installation, read this TR (pages 1 thru 5).

# MAIN LEG ASSEMBLY REMOVAL/INSTALLATION

**WARNING: TAKE CARE WHEN IN THE VICINITY OF LANDING GEARS BEING RETRACTED AND LOWERED. SEVERE INJURY CAN RESULT FROM BEING STRUCK BY THE GEAR OR DOORS.**

**WARNING: GROUND LOCKING PINS MUST BE INSTALLED WHENEVER THE MAIN AND NOSE LANDING GEARS ARE IN THE DOWN AND LOCKED POSITION.**

**WARNING: BEFORE YOU DISMANTLE ANY PART OF THE LANDING GEAR HYDRAULIC SYSTEM, MAKE SURE THAT ALL HYDRAULIC PRESSURE IS RELEASED (CHAPTER 29, HYDRAULIC POWER).**

**CAUTION: BEFORE YOU RETRACT THE LANDING GEARS, MAKE SURE THAT THE GEAR BAYS ARE FREE FROM LOOSE ARTICLES AND THAT THE GEAR RETRACTION PATH IS FREE FROM OBSTRUCTION.**

**CAUTION: HYDRAULIC FLUID DRAINED OR BLED FROM THE LANDING GEAR SYSTEM IS TO BE DISCARDED. USE ONLY NEW HYDRAULIC FLUID TO REPLENISH THE SYSTEM OR GROUND SERVICING RIGS.**

## 1. Removal *(Figure 1)*

| Equipment/Materials | Part/Item No. |
|---|---|
| Grease | 078 (Ref. AMM 125/H-20, Chapter 20-95-11) |
| Sealing compound | 316 (Ref. AMM 125/H-20, Chapter 20-95-301) |
| Engine oil or oil | 126 (Ref. AMM 125/H-20, Chapter 20-95-101) |
| Torque wrench 50.0 lb ft. and 150.0 lb ft. | Local supply |

### A. Procedure

(1) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING).

(2) Release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Remove the wheels (Chapter 32, MAIN WHEELS).

(4) Remove the brake units (Chapter 32, BRAKE UNITS).

**WARNING: BE CAREFUL WHEN RELEASING PRESSURIZED NITROGEN FROM THE STRUT.**

- **PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.**
- **RELEASE THE PRESSURE SLOWLY.**
- **A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY.**

**CAUTION: FAILURE TO RELEASE THE PRESSURE SLOWLY MAY RESULT IN DAMAGE TO THE STRUT INTERNAL STOPS.**

(5) Slowly release the nitrogen pressure from the strut through the charging adaptor and make sure the strut is fully bottomed.

*NOTE: Install blanks to all disconnected hydraulic components and pipe connections.*

(6) Disconnect the hydraulic hoses at the upper adapters on the support bracket adjacent to the lower sidestay connections.

(7) If the existing hydraulic hoses are to be transferred to the new leg, suitably identify then remove the hoses. Install blanking caps to the hose ends.

(8) Disconnect the flap screw jack attachment fitting and flap synchronizer transmitter mechanism (Chapter 27, FLAP CONTROL SYSTEM).

(9) Remove the flap synchronizer transmitter mechanism mounting bracket.

(10) On the left-hand leg only, isolate the relevant electrical circuit (Chapter 24, GENERAL). Disconnect the lever lock microswitch cables from the terminal block JK (installed in the left-hand main gear bay). Withdraw the cables from the conduits in the gear bay.

(11) Disconnect the fairing strut from the fairing.

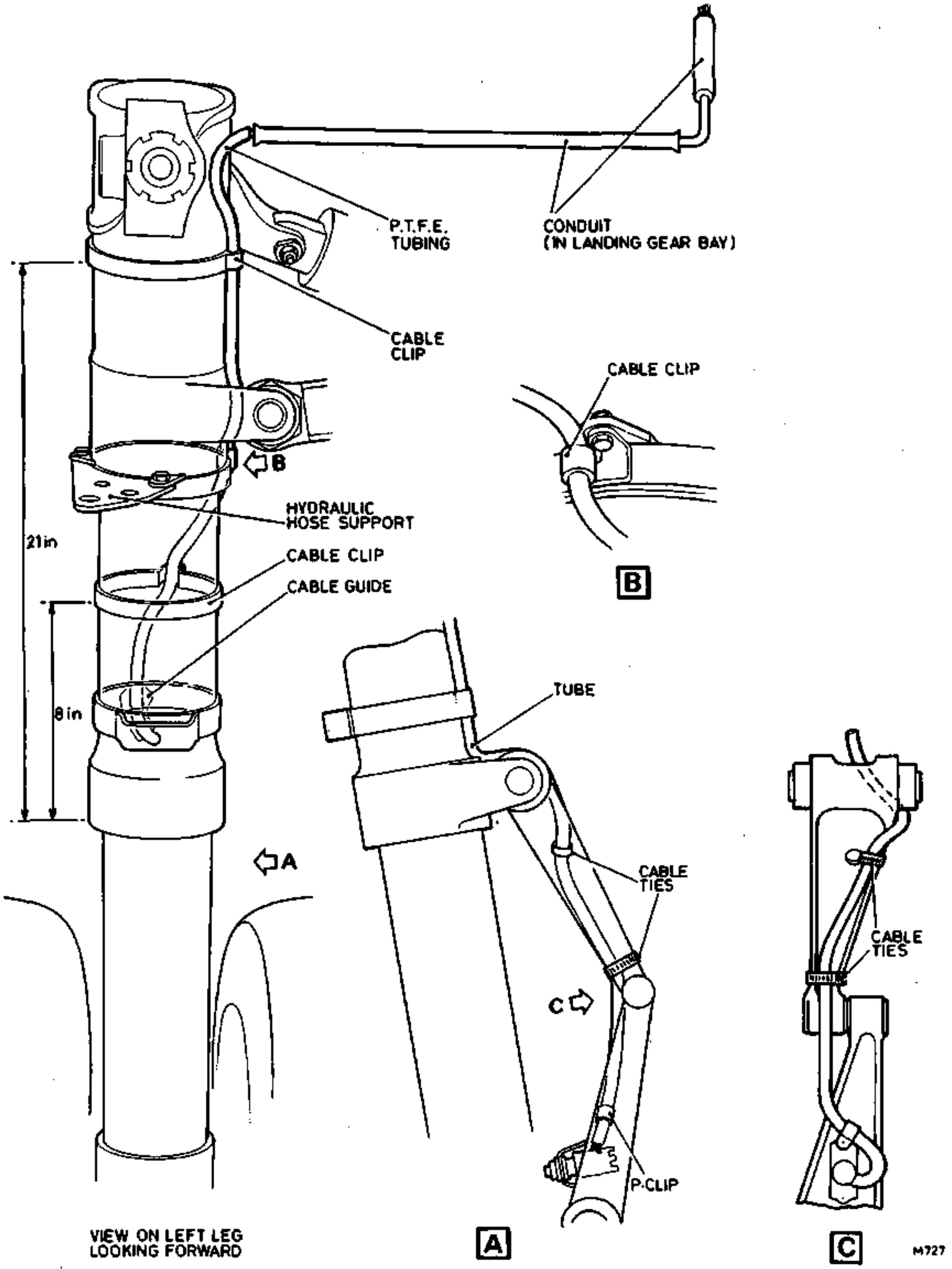
(12) Remove the lower shroud panel.

(13) Remove the pin and disconnect the ram eye end from the leg retraction lever.

(14) Unscrew the nut securing the lower arm of the side stay to the leg (Chapter 32, SIDE STAY ASSEMBLY).

(15) Support the leg, remove the forward and aft trunnion attachment nuts and bolts, and lower the leg assembly (complete with trunnions) disengaging the leg from the lower arm of the side stay.

(16) If a new leg is to be installed and the existing microswitch cable guide tube is required for the new leg, withdraw the microswitch cables and remove the tube.



Microswitch cables - installation details.
*Figure 1*

## 2. Installation *(Figure 1)*

### A. Procedure

(1) If a new leg is being installed, thread the lever lock microswitch cables through the guide tube, then install the tube to the leg.

(2) Remove the side stay at the upper connection (Chapter 32, SIDE STAY ASSEMBLY).

(3) Make sure that the trunnion bolts have been degreased, and before installing, apply sealing compound (Item 316) under the head and on the shank of the bolt. Use engine oil as a lubricant for the threads of the nuts and bolts.

(4) Install the leg assembly to the structure, and install the trunnion bolts as follows:

  (a) Install the two aft trunnion attachment upper bolts with the heads inboard, and install the washers and nuts. Lightly tighten the nuts.

  (b) Install the two aft trunnion attachment lower bolts with the heads outboard, and install the washers and nuts. Lightly tighten the nuts.

  (c) Install the two forward trunnion attachment bolts and nuts. Lightly tighten the bolts.

(5) Torque tighten the trunnion attachment bolts and nuts as follows:

  (a) Progressively torque tighten, diagonally, all four aft trunnion nuts to between 61.0 and 67.0 lb ft. (82.72 and 90.85 Nm). Install a split pin to lock each nut.

  (b) Progressively torque tighten both forward trunnion bolts until the upper bolt is between 61.0 and 67.0 lbf ft. (82.72 and 90.85 Nm) and the lower bolt is between 121.0 and 133 lbf ft. (164.08 and 180.35 Nm). Wirelock the bolts to the trunnion block.

*NOTE: Remove blanks from hydraulic components and pipe connections as necessary.*

(6) Install the side stay assembly (Chapter 32, SIDE STAY ASSEMBLY).

**CAUTION: MAKE SURE THAT THE GREASE NIPPLE ON THE JACK EYE END AT LEG RETRACTION LEVER IS FACING UPWARD.**

(7) Attach the retraction actuator to the leg retraction lever (pin head forward) and lock with a split pin.

(8) Install and secure the fairing strut to the fairing.

(9) Install the flap synchronizer transmitter mechanism mounting bracket.

(10) Install and secure the flap screwjack attachment fitting and the flap synchronizer transmitter mechanism (Chapter 27, FLAP CONTROL SYSTEM).

(11) Fill the strut with hydraulic fluid (Chapter 32, SERVICING).

(12) Pressurize the strut with nitrogen (Chapter 12, SERVICING).

(13) Install the brake units (Chapter 32, BRAKE UNITS).

(14) Remove blanks from hose ends. Install and secure the brake hoses and wirelock the connections.

(15) On the left-hand leg only, thread the lever lock microswitch cables through the conduits in the gear bay and connect the cable ends to the relevant terminals on terminal block JK (installed in the left-hand main gear bay). Reset the circuit breaker and install the fuse. Adjust the lever lock microswitch (Chapter 32, LANDING GEAR SELECTOR CONTROLS).

(16) Install the lower shroud panel.

**CAUTION: DO NOT OVER-TIGHTEN THE BLEED SCREWS.**

(17) Bleed and test the brakes (Chapter 32, WHEELS AND BRAKES).

(18) Install the wheels (Chapter 32, MAIN WHEELS).

*NOTE: If the lower cable/hose clamp is disturbed it should be positioned to give maximum clearance between itself and both tires.*

(19) On pre-mod. 252488 airplanes:

(a) With flaps up and leg down, make sure that the clearance between the locking wire of the leg rear trunnion nut and the flap screw jack is not less than 0.1 in. If necessary, the locking wire tab on the washer (25UM149) behind the trunnion nut, can be bent over to get a minimum clearance. Re-lock the trunnion nut if necessary.

(20) Adjust the fairing strut as necessary (Chapter 32, MAIN GEAR FAIRINGS).

(21) Make sure all disturbed connections are locked and cable ties and clips are secure.

(22) Do a functional test of the landing gear (Chapter 29, MAIN SYSTEM).

(23) Do a functional test of the flap control and flap synchronizer transmitter mechanism (Chapter 27, FLAP CONTROL SYSTEM).

(24) Lower the airplane (Chapter 7, LIFTING AND SHORING).

**CAUTION: DO NOT OVERTIGHTEN THE BLEED SCREWS AS THIS CAN CAUSE DISTORTION OF THE PRESSURE HEAD.**

(9) Liberally coat both bleed screws with silicone grease (Item 046). Remove the tubing and install one of the bleed screws to the open bleed screw hole.

(10) Continue to pump hydraulic fluid into the strut until maximum pressure of 200 psi. is reached, this makes sure that the separator piston is forced to the bottom of the plunger tube. Stop pumping and make sure that the strut holds this pressure for a minimum of two minutes.

NOTE: *Failure to hold this pressure indicates leakage from the pump unit or strut and both should be examined. If there is no evidence of leakage, the drop in pressure is probably because the separator piston has continued to 'creep' to its 'bottomed' position, because of the relatively low pressure applied.*

(11) Continue to pump hydraulic fluid slowly into the strut (maximum pressure 200 psi.) until a steady pressure is achieved, it may then be concluded that the piston has 'bottomed'.

(12) Release the pressure. Make sure that the strut is fully bottomed and disconnect the pump and adapter and install the remaining bleed screw.

(13) Install a new O-ring seal to the charging valve and screw the valve into its adapter. Install the locking plate.

(14) Pressurize the leg with nitrogen (Chapter 12, SERVICING - LANDING GEAR) to extend the shock absorber strut and to raise the airplane to its normal attitude.

(15) Make sure all disturbed connections are locked.

(16) Remove the gear locking pins.

## 2. Removal/Installation

### A. Remove leg assembly

NOTE: *Install blanks to all disconnected hydraulic components and pipe connectors.*

(1) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING).

(2) Release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Remove the wheels (Chapter 32, MAIN WHEELS).

(4) Remove the brake units (Chapter 32, BRAKE UNITS).

(5) Disconnect the hydraulic hoses at the support bracket adjacent to the lower side stay connection.

(6) Airplanes Post Mod. 255640.

(a) Disconnect the flap screwjack attachment fitting and the flap synchronizer transmitter mechanism (Chapter 27, FLAP CONTROL SYSTEM).

(b) Remove the transmitter mechanism mounting bracket.

*NOTE: Please see the* ***TEMPORARY REVISION*** *that revises this page.*

(7) On the left-hand leg only, isolate the relevant electrical circuit. Disconnect and remove the cables to the microswitch.

(8) Disconnect the fairing strut at the fairing.

(9) Remove the lower shroud panel.

(10) Disconnect the hydraulic jack at the leg operating lever.

(11) Unscrew the nut securing the lower arm of side stay to the leg.

(12) Support the leg and remove the trunnion securing bolts. Lower the leg assembly (complete with trunnions) and disengage the leg from the lower arm of the side stay.

### B. Install leg assembly

*NOTE: Remove blanks from hydraulic components and pipe connectors.*

(1) Remove the side stay at the upper connection (Chapter 32, SIDE STAY ASSEMBLY).

(2) Make sure the fluid level in the leg is correct and is pressurized with nitrogen to the correct pressure (Paragraph 1.C. and Chapter 12, SERVICING - LANDING GEAR).

(3) Offer up the leg assembly and install and wire lock the trunnion securing bolts.

(4) Install the side stay assembly (Chapter 32, SIDE STAY ASSEMBLY).

**CAUTION: MAKE SURE THE GREASE NIPPLE ON THE JACK EYE-END AT THE LEG OPERATING LEVER IS FACING UPWARD.**

(5) Attach the hydraulic jack to the leg lever (pin head forward) and lock with a split pin.

(6) Connect the fairing strut to the fairing.

(7) Airplanes Post Mod. 255640.

  (a) Install the flap synchronizer transmitter mechanism mounting bracket.

  (b) Connect the flap screwjack attachment fitting and the flap synchronizer transmitter mechanism (Chapter 27, FLAP CONTROL SYSTEM).

(8) Install the brake units (Chapter 32, BRAKE UNITS). Install the brake hoses and wire-lock.

(9) On the left-hand leg only, install the microswitch cables. Restore the relevant electrical circuit. Adjust the microswitch (Chapter 32, LANDING GEAR SELECTOR CONTROLS).

(10) Install the lower shroud panel.

**CAUTION: DO NOT OVER-TIGHTEN THE BLEED SCREWS.**

(11) Bleed and test the brakes (Chapter 32, WHEELS AND BRAKES).

(12) Install the wheels (Chapter 32, MAIN WHEELS).

*NOTE: Please see the*
***TEMPORARY REVISION***
*that revises this page.*

NOTE: *If the lower cable/hose clamp is disturbed it should be positioned to give maximum clearance between itself and both wheels.*

(13) On pre-mod.252488 airplanes:

(a) With flaps up and leg down, check the clearance between the locking wire of the leg rear trunnion nut and the flap screw jack is not less than 0.1 in. If necessary, the locking wire tab on the washer behind the trunnion nut, can be bent over to obtain minimum clearance. Re-lock the trunnion nut if necessary.

(14) Adjust the fairing strut if necessary (Chapter 32, MAIN GEAR FAIRINGS).

(15) Do a functional test of the landing gear (Chapter 29, MAIN SYSTEM).

(16) Do a functional test of the flap control and flap synchronizer transmitter mechanism (Chapter 27, FLAP CONTROL SYSTEM).

(17) Make sure all disturbed connections are locked.

(18) Lower the airplane (Chapter 7, LIFTING AND SHORING).

## 3. Approved repairs

### A. Replace gland seals in situ *(Figure 201, Figure 202)*

| Equipment/Material | Part/Item No. |
|---|---|
| Spanner, retaining nut | 25Y613A/B |
| Actuator clamp | 25Y1491-31A |
| Grease, low temperature | 078 (Chapter 20-95-11) |
| Grease, general purpose | 040 (Chapter 20-95-11) |
| Hydraulic fluid | 107 (Chapter 20-95-101) |
| Sealing compound | 314 (Chapter 20-95-301) |
| De-greasing agent | 230 (Chapter 20-95-201) |

NOTE: *Install blanks to all disconnected hydraulic components and pipe connectors.*

(1) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING).

(2) Remove the wheels (Chapter 32, MAIN WHEELS).

(3) Remove the brake unit (Chapter 32, BRAKE UNIT).

**WARNING: BE CAREFUL WHEN RELEASING PRESSURIZED NITROGEN FROM THE LEG. RELEASE THE PRESSURE SLOWLY, A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY. PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.**

*NOTE: Please see the*
***TEMPORARY***
***REVISION***
*that revises this page.*

**WARNING: FAILURE TO RELEASE PRESSURE FROM A LEG WITH A FAULTY SEPARATOR SEAL MAY RESULT IN PERSONNEL INJURY DURING SUBSEQUENT DISASSEMBLY.**

(4) Slowly release nitrogen pressure from the leg through the charging adaptor.

(5) Remove one of the two bleed screws at the top of the leg to release any nitrogen pressure that may be present due to leakage past the separator. Faulty separator seals must be changed in accordance with instructions in the 125 Overhaul Manual.

(6) Release the hydraulic system pressure (Chapter 29, MAIN SYSTEM).

(7) Use a suitable container to collect spilt hydraulic fluid and disconnect the brake pipelines at the lower connections.

(8) Remove the maxaret unit and modulator (Chapter 32, MAXARET UNIT).

(9) Remove the bottom bolt and pin and disconnect the torque link. If seals on the left-hand leg are to be replaced, isolate the microswitch electrical circuit (Chapter 24, ELECTRICAL - GENERAL).

*NOTE: Protect the microswitch and the torque links during the following paragraphs.*

(10) Remove the locking tab and unscrew the adapter, complete with charging valve, from the leg.

(11) Separate the axle assembly from the plunger tube. Remove any sealant adhering to the plunger tube, making sure not to damage the chrome plate.

(12) Partially retract the leg, and support it at a suitable angle, make provision for spilt hydraulic fluid.

(13) Remove the bolts securing the locking plate and remove the locking plate. Use the special spanner to unscrew the retaining nut from the upper casing and withdraw the plunger tube sufficiently to expose the lower bearing bush and seals assembly.

(14) Pre-mod.251928 *(Figure 201)*:

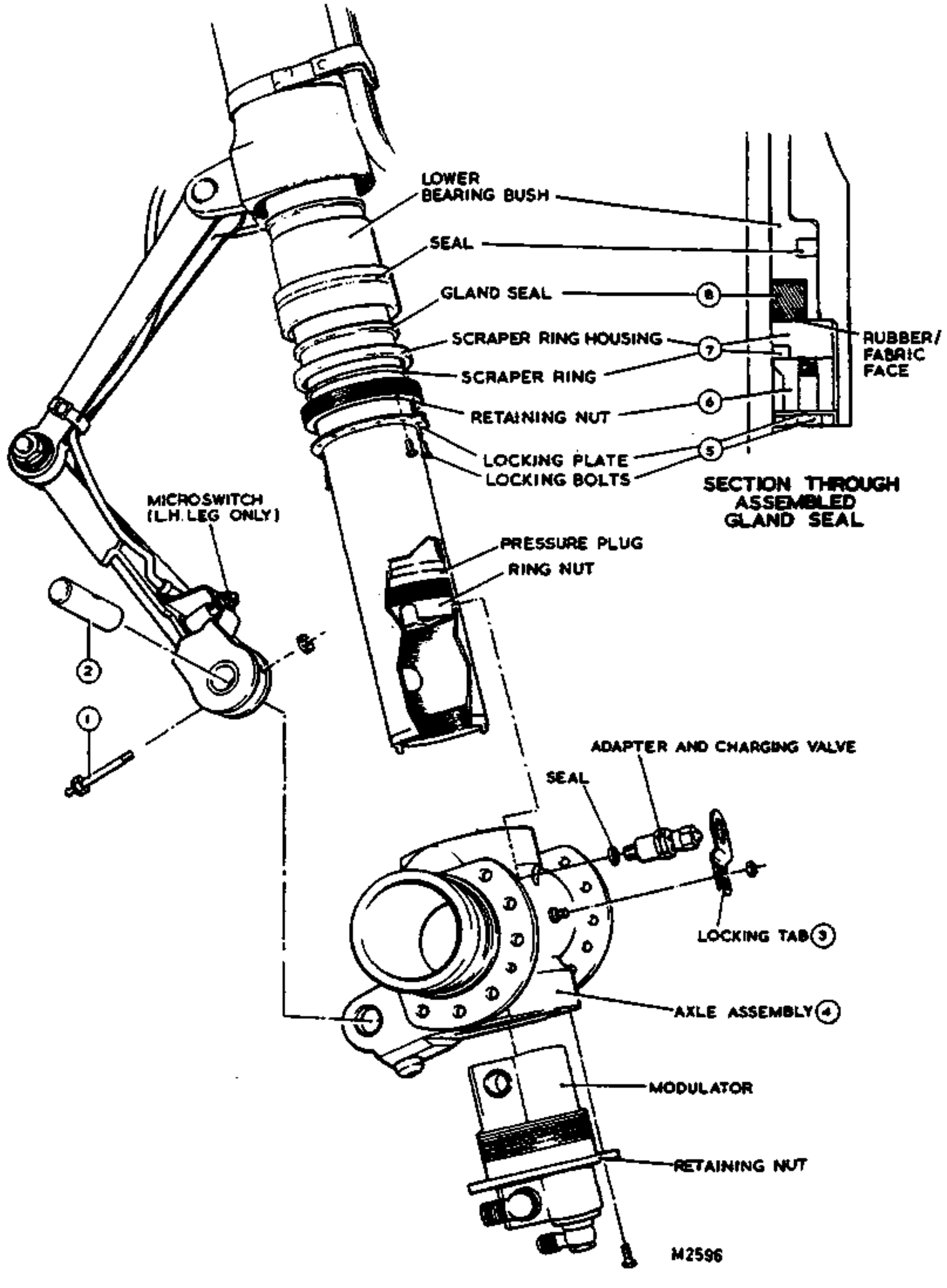
    (a) Remove the seal housing and scraper ring.

**CAUTION: MAKE SURE THE GLAND SEAL IS INSTALLED CORRECTLY WITH THE RUBBER/ FABRIC FACE DOWNWARDS.**

    (b) Install new gland seal and new seal between lower bearing and upper casing. Assemble seals with hydraulic fluid.

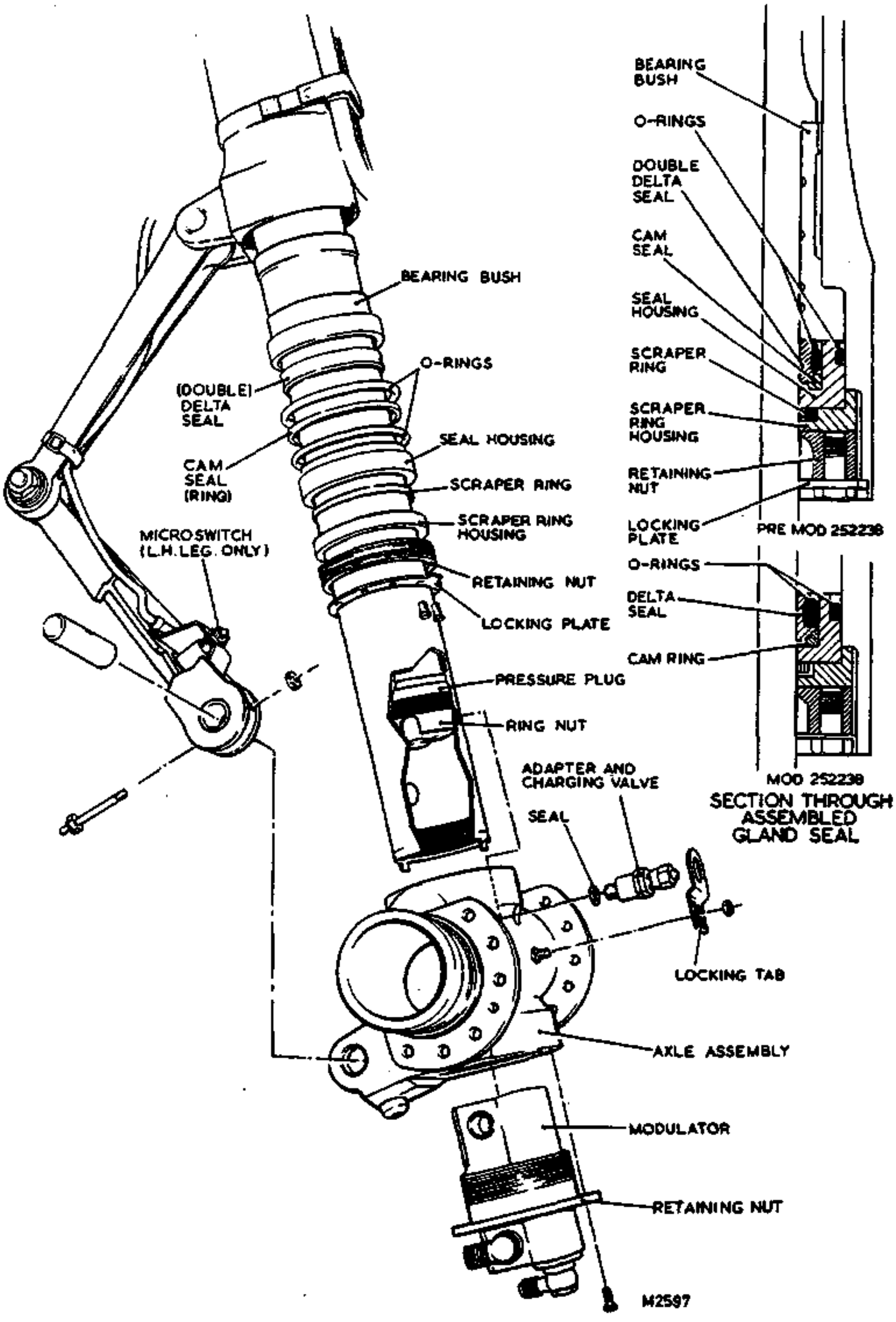
    (c) Inspect the scraper ring and replace if necessary. Install the seal housing and scraper ring.

    (d) Push the plunger tube up and locate the lower bearing bush gland seal, seal housing and scraper ring in upper casing. Install and tighten the retaining nut with the special spanner. Install the locking plate and locking bolts, wire lock the bolts in pairs. Clean off excess fluid from the plunger tube.



Seal removal and installation (Pre-mod.251928)

*Figure 201*



Seal removal and installation (Mod.251928 and Mod.252238)

*Figure 202*

(15) Mod.251928 and Mod.252238 *(Figure 202)*

(a) Remove the scraper ring housing and scraper ring from the plunger tube.

(b) Remove the seal housing from the plunger tube.

(c) Remove the cam seal (ring), O-ring seal and the (double) delta seal. Remove the O-ring seal from the top outer edge of seal housing.

**CAUTION: BEFORE ASSEMBLY OF SEALS, MAKE SURE THAT THE SURFACE OF THE PLUNGER TUBE IS SCRUPULOUSLY CLEAN AND THAT THERE IS NO TRACE OF ROUGHNESS AT THE END OF THE TUBE. THE DOUBLE DELTA SEAL WILL BE RENDERED INEFFECTIVE IF SCRATCHED OR SCORED IN ANY WAY.**

*NOTE: Assemble all seals with hydraulic fluid, except the Mod.252238 delta seal which is assembled with grease (Item 040).*

(d) Slide the (double) delta seal over the plunger tube and change of section, assemble the O-ring to the (double) delta seal and install the cam seal (ring).

(e) Install the O-ring seal to the seal housing. Inspect the scraper ring and replace if necessary. Slide the seal housing, scraper ring, scraper ring housing and the retaining nut onto the plunger tube.

(f) Carefully install the seal housing over the O-ring seal on the (double) delta seal.

(g) Ease the bearing bush, seal sub-assembly, scraper ring and scraper ring housing into the outer casing.

(h) Lubricate the retaining nut with grease (Item 078) and tighten with the special spanner. Install the locking plate and secure with bolts, wire-lock the bolts in pairs. Clean off excess fluid from the plunger tube.

(16) Offer up the axle assembly, locating the plunger tube dogs in the axle slots. Use a new sealing ring, screw in the adapter complete with the charging valve. Secure the locking tab and tighten the nut securing tab.

(17) Connect the torque link; insert the pin and bolt, secure and tighten the nut. Lock with a split pin.

(18) Install the modulator and maxaret units (Chapter 32, MAXARET UNIT).

(19) Clean around the joints with Item 230, or equivalent, and apply fillets of sealing compound (Item 314) in accordance with Chapter 20-10-1002 to the plunger-tube-to-axle joint and around the charging valve adaptor.

(20) Do a test of the lever lock microswitch (Chapter 32, LANDING GEAR SELECTOR CONTROLS).

(21) Make sure the fluid level in the leg is correct and is pressurized with nitrogen to the correct pressure (Paragraph 1.C. and Chapter 12, SERVICING - LANDING GEAR).

*NOTE: Remove blanks from hydraulic components and pipe connectors.*

(22) Install the brake unit (Chapter 32, BRAKE UNIT).

(23) Install the wheels (Chapter 32, MAIN WHEELS).

**CAUTION: DO NOT OVERTIGHTEN THE BLEED SCREWS.**

(24) Bleed and test the brakes (Chapter 32, WHEELS AND BRAKES).

(25) Make sure all disturbed connections are locked.

(26) Lower the airplane (Chapter 7, LIFTING AND SHORING).

## 4. Check the torque link pivots for wear *(Figure 203, Figure 204, Figure 205)*

| Equipment/Material | Part/Item No. |
|---|---|
| Dial test indicator | Refer to *Figure 205* |
| Grease | 078 (Chapter 20-95-11) |
| Dry abrasive paper | 632 (Chapter 20-95-601) |

*NOTE: This check is applicable to both LH and RH MLG torque link assemblies.*

*NOTE: It is essential that all items are thoroughly cleaned before any checks for damage or dimensional checks are done.*

### A. Check torque links

(1) Display 'DO NOT USE THE LANDING GEAR' warning signs in the flight compartment.

(2) Open, safety and tag the landing gear circuit breakers (Chapter 24, ELECTRICAL POWER – GENERAL).

(3) Make sure that the ground locks are installed.

(4) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING). Make sure that the main gear oleos are fully extended.

(5) Attach a Dial Test Indicator (DTI) to the torque link lug on the leg casing.

(6) Set the plunger of the DTI on the forward inboard rim of the inboard wheel. Make sure the gauge is indicating zero.

(7) Facing the inboard wheel, grip the tire at its front and rear extremities and rotate the axle using a jarring action in each direction. Record the total rotational movement of the axle relative to the leg casing. There must not be more than 0.035 in.(0.89 mm) total movement measured at the wheel rim. Remove the DTI.

*NOTE: If the movement is less than 0.035 in.(0.89 mm) do paragraphs (8) to (12) inclusive.*

*NOTE: If the movement is more than 0.035 in.(0.89 mm) do paragraphs (13) to (22) inclusive.*

(8) Refer to the CMM Chapter 32-10-11.

(a) Mark the upper torque link pin to make sure the pin is installed in original position on assembly.

(b) Remove the upper torque link pin and visually examine the pin, do a check for the following:

- Distortion )
- Evidence of wear )
- Necking )
- Ovality )
- Blockage of grease lubrication holes

Check against dimensions in CMM for any of these, if any discrepancies are found the pin should be replaced.

(c) Do a dye penetrant crack test on the pin. If any cracks are found the pin should be replaced.

(d) Remove the lever lock microswitch (LH MLG, do not disconnect) and remove the cable ties as necessary to let the upper and lower torque links be moved.

(e) While the pin is removed, make sure that the lower torque link is free to rotate in the axle and the upper torque link is free to rotate in the lower torque link. Make sure that there is no contact between the lower torque link and the axle over the operating area. If any chafing is found rectify as shown.

NOTE: *If there is any restriction of movement at either of these positions, the bush face clearances should be checked and rectified as detailed in paragraphs (15) and (16).*

(f) Install the torque link pin in the leg casing bushes (in the original position as marked at paragraph (8)(a) and without the torque link in place), and make sure that the pin is free to rotate. Remove the pin.

(g) Install the torque link between the bushes in the leg casing (do not install the pin at this stage) and make sure that it is not a tight fit.

NOTE: *If the torque link is a tight fit, the bush face clearances should be checked and rectified as given in paragraph (15).*

(h) Refer to the CMM Chapter 32-10-11. Install the upper torque link to the leg casing.

NOTE: *When the torque link is being assembled to the leg casing, make sure that the bushes and pin are hand lubricated with grease (Item 078).*

(i) Install the lever lock microswitch removed at paragraph (8)(d), renew cable ties as required.

(j) Adjust the lever lock microswitch (Chapter 32-30-11, SELECTOR CONTROLS).

**CAUTION: WHEN LOWERING AIRPLANE OFF JACKS, MAKE SURE THAT THE LEVER LOCK MICROSWITCH CABLES DO NOT FOUL ANYWHERE ON THE TORQUE LINK ASSEMBLIES.**

(9) Lower the airplane off jacks (Chapter 7, LIFTING AND SHORING).

(10) Close the circuit breakers opened at paragraph (2).

(11) Remove the warning signs displayed at paragraph (1).

(12) Refer to Maintenance Schedule - Lubrication. Apply grease to all nipples on the torque link assembly as shown.

*NOTE: Paragraphs (13) to (22) inclusive are for torque link assemblies that have more than 0.035 in. total axle rotational movement.*

(13) Remove the main wheels (Chapter 32, MAIN WHEELS).

(14) Remove the brakes (Chapter 32, BRAKE UNIT).

(15) Do a check of the clearance at the upper and lower torque links:

(a) Make sure the clearance is correct between:

- the bushes installed in the torque link and the bushes installed in the leg casing (upper)

and,

- the bushes installed in the torque link and the bushes installed in the axle (lower).

The total clearance should be 0.002 in. to 0.010 in. (0.0508 mm to 0.254 mm).

*NOTE: Clearances should be checked with the torque links pushed to one side.*

(b) If clearance is more than 0.010 in. the bushes in the leg casing (upper) or the axle (lower) should be replaced. New bushes should be installed as detailed in CMM Chapter 32-10-11.

**CAUTION: WHEN FETTLING BUSHES, USE A FLAT PLATE WITH THE ABRASIVE PAPER TO MAKE SURE THE BUSH FACES ARE FLAT AFTER REWORK.**

If new bushes are installed clearances must be checked after installation and bush faces fettled to get the correct clearance using wet and dry abrasive paper (1200 grade).

*NOTE: When fettling bushes make sure an equal amount of material is removed from each bush.*

If after installing new bushes in the leg casing or the axle, the clearance is still more than 0.010 in. the bushes in the respective torque link should be replaced and the clearances checked again. New torque link bushes should be installed as given in CMM Chapter 32-10-11.

(c) If the clearance is less than 0.002 in. the bushes in the leg casing (upper) or axle (lower) can be fettled to get the correct clearance.

(d) Remove the upper and lower torque link pins and do a visual examination of both pins. Do a check for the following:

- Distortion )
- Evidence of wear )
- Necking )
- Ovality )
- Blockage of grease lubrication holes.

Do a check against dimensions in CMM, if the torque link pins are not to the dimensions stated, they should be replaced.

(e) Do a dye penetrant crack test on both pins. If any cracks are found replace the pin.

(f) Using suitable measuring equipment do an internal dimension check of the leg casing and the axle bushes. If the bushes are not to the CMM dimensions they should be replaced. If new bushes are installed clearances should be checked as given in paragraph (15)(a).

(g) Make sure that there has been no contact between the lower torque link and the axle over the operating area. If any chafing is found repair as shown.

(16) Do a check at the connecting joint between the upper and lower torque links as given below.

**CAUTION: UNDER NO CIRCUMSTANCES SHOULD THE ANTI ROTATIONAL WASHER BE FETTLED TO GET THE CORRECT CLEARANCES AT THE CONNECTING JOINT.**

(a) Do a check of the clearance between the bush face and anti rotational washer. The clearance should be 0.001 in. to 0.007 in. (0.0254 mm to 0.178 mm).

If the clearance is more than 0.007 in. the bushes should be replaced.

If the clearance is less than 0.001 in. the bushes may be fettled as given in paragraph (15)(b) to get the correct clearance.

If new bushes are installed, do a check for correct clearance and fettle as necessary. New bushes should be installed as given in CMM Chapter 32-10-11.

(b) Dismantle the connecting joint between the upper and lower torque links, remove the connecting bolt and do a visual examination of the bolt. Do a check for the following:

- Distortion )
- Evidence of wear )
- Necking )
- Ovality )

Do a check of the connecting bolt against the dimensions stated in the CMM, if the bolt is outside the stated dimensions, it should be replaced.

(c) Do a dye penetrant crack test on the connecting bolt, if any cracks are found the bolt should be replaced.

*NOTE: Be careful when crack testing this item. A 'chrome run out' may show up as a crack.*

(d) Using suitable measuring equipment do an internal dimension check of the connecting joint bushes. If the bushes are not to the dimensions given in the CMM they should be replaced. If new bushes are installed do a check of the bush clearances as given in paragraph (16)(a).

(e) Do a check of the anti rotational washer for wear, the washer should be replaced if visibly worn.

(f) Assemble the connecting joint as given in the CMM and do a final check that the clearance between the anti rotational washer and bush head is 0.001 in. to 0.007 in. (0.0254 mm to 0.178 mm). When assembling the connecting joint, hand lubricate the pin and bushes using grease (Item 078).

(17) Refer to CMM Chapter 32-10-11. Install the torque link assembly to the leg casing and axle.

*NOTE: When the torque link is being assembled to the leg casing/axle, make sure that all bushes and pins are hand lubricated, with grease (Item 078).*

(18) Do a final check of all the relevant clearances of the bush faces on the torque link assembly. If any of these are incorrect the necessary operations should be repeated to get the correct clearances.

(19) Install the brakes (Chapter 32, BRAKE UNIT).

(20) Install the main wheels (Chapter 32, MAIN WHEELS).

(21) Bleed and test the brakes (Chapter 32, WHEELS AND BRAKES).

(22) Do paragraphs (5) to (7) inclusive to check rotational movement, make sure that this is less than 0.035 in. (0.89 mm).

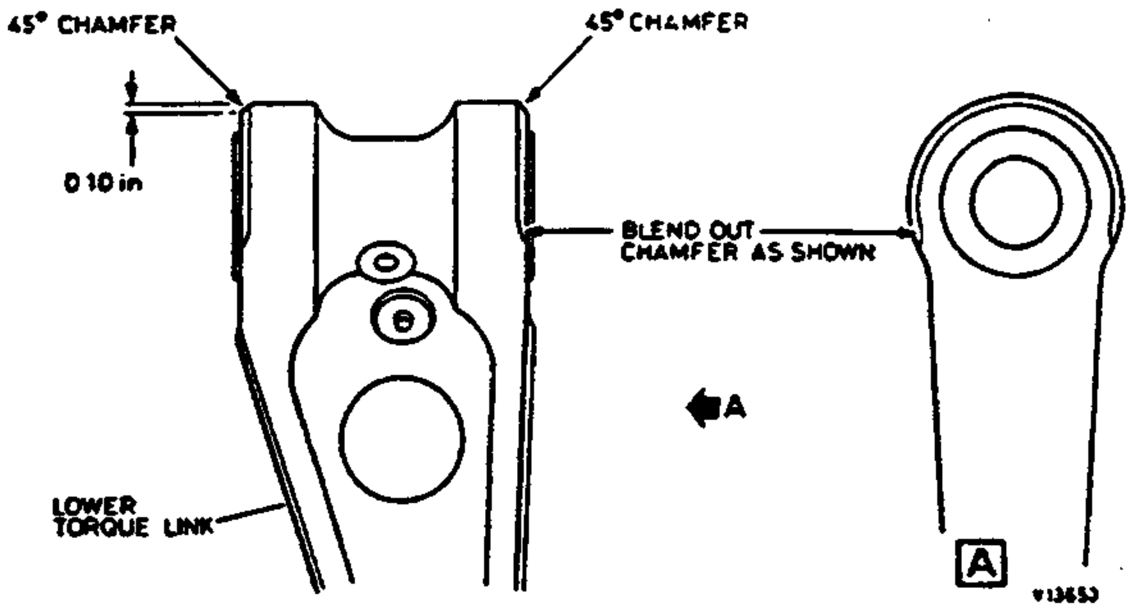
(23) Do paragraphs (9) to (12) inclusive.

*NOTE: If any chafing is found between the lower torque link and the axle over the operating area make sure that a 0.10 in. (2.54 mm)/45° chamfer exists as shown.*

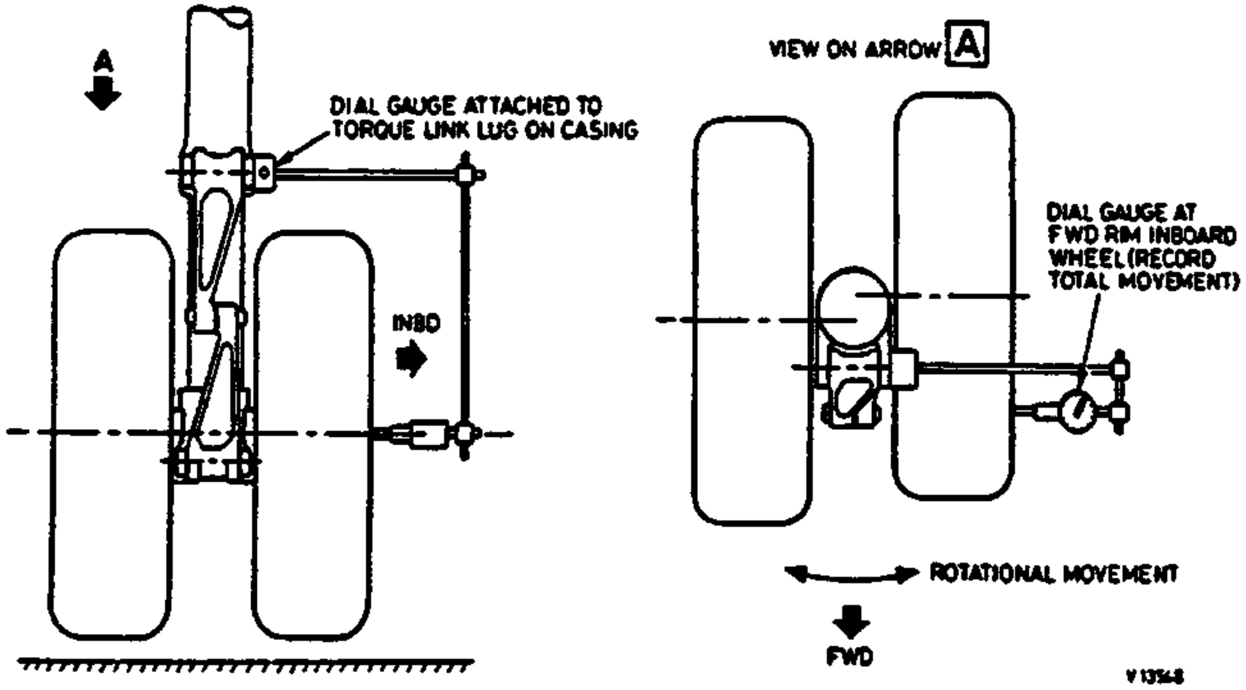
*NOTE: If the chamfer is not to the dimensions shown, use suitable hand tools to remove material from the torque link to produce the required chamfer and blend out the chamfer as shown.*

*NOTE: After removing material, thoroughly degrease the area worked and repair the protective treatment and surface finish (CMM Chapter 32-10-11).*

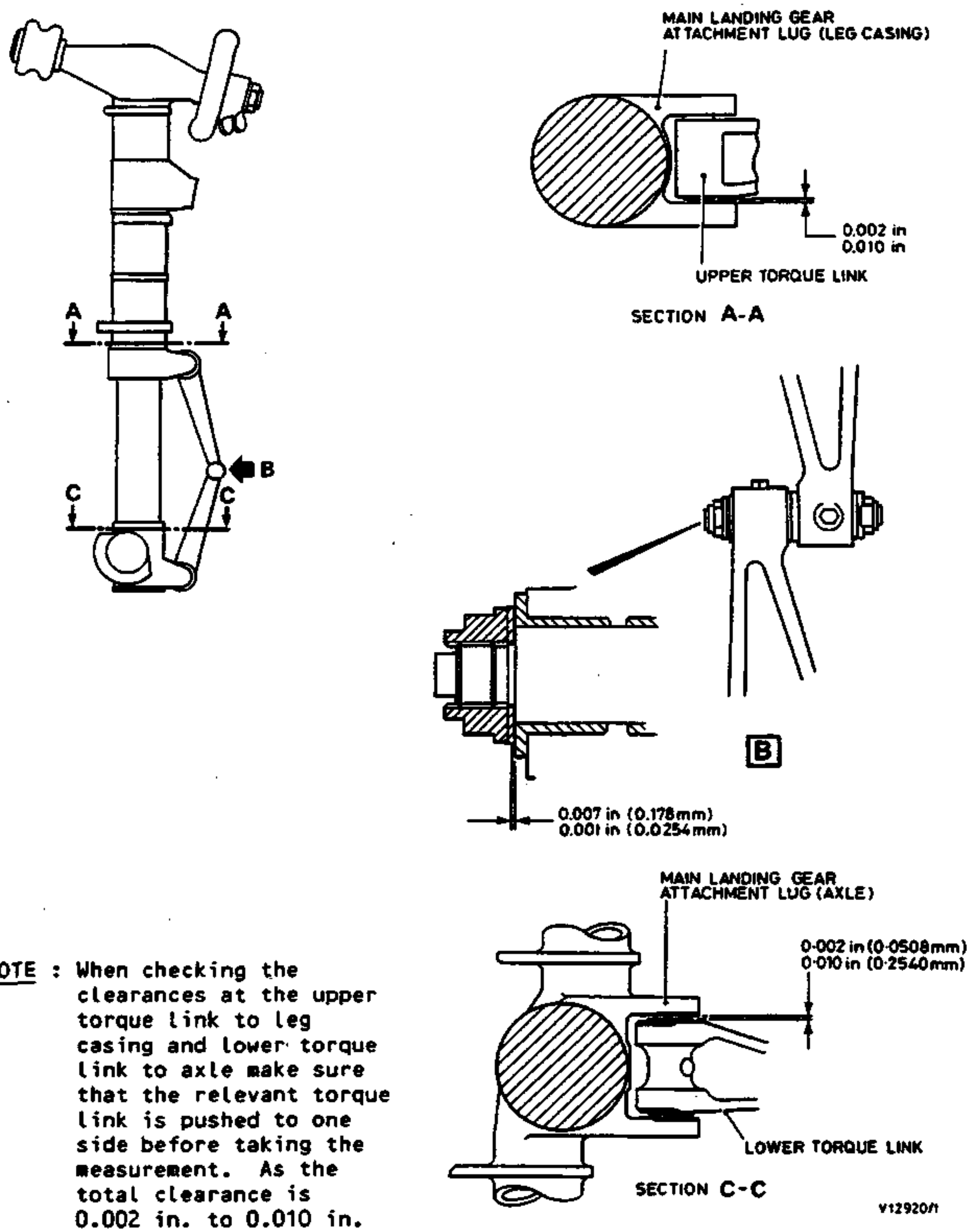
*NOTE: When the lower torque link is installed, make sure that there is no chafing between the torque link and the axle.*



Lower torque link - checking for chamfer
*Figure 203*


A
DIAL GAUGE ATTACHED TO TORQUE LINK LUG ON CASING
INBD
VIEW ON ARROW A
DIAL GAUGE AT FWD RIM INBOARD WHEEL (RECORD TOTAL MOVEMENT)
ROTATIONAL MOVEMENT
FWD
V13568

Measurement of axle rotational movement
*Figure 204*



NOTE : When checking the clearances at the upper torque link to leg casing and lower torque link to axle make sure that the relevant torque link is pushed to one side before taking the measurement. As the total clearance is 0.002 in. to 0.010 in.

Torque link assembly - bush clearances

*Figure 205*

# SIDE STAY ASSEMBLY - REMOVAL/INSTALLATION

## 1. Side Stay Assembly

| Equipment/Material | Part/Item No. |
|---|---|
| Extractor | 25Y261A |
| Spanner, retaining nut | 25Y259A |
| Door jack clamp | 25Y1491A |
| Grease | 078 (Chapter 20-95-11) |
| Sealing compound | 314 (Chapter 20-95-301) |

### A. Removal *(Figure 401)*

(1) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(2) Release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

**WARNING: MAKE SURE THE CLAMP IS FITTED ON THE DOOR JACK RAM.**

(3) Manually open the main gear door and install the door jack clamp.

(4) At the upper end of the side stay, remove the locking stud from the nut at the rear of the main locating pin and use the special spanner to remove the retaining nut.

(5) Remove the two bolts holding the extension lever to the lever assembly.

(6) Disconnect the main hydraulic jack from the side stay pivot fitting.

*NOTE: If the side stay incorporates Mod.252091 (eccentric bush in jack pivot), note the position of the flats of the eccentric bush in relation to the arrow head on the pivot fitting. The eccentric bush provides adjustment for minimizing the jack ram over-travel.*

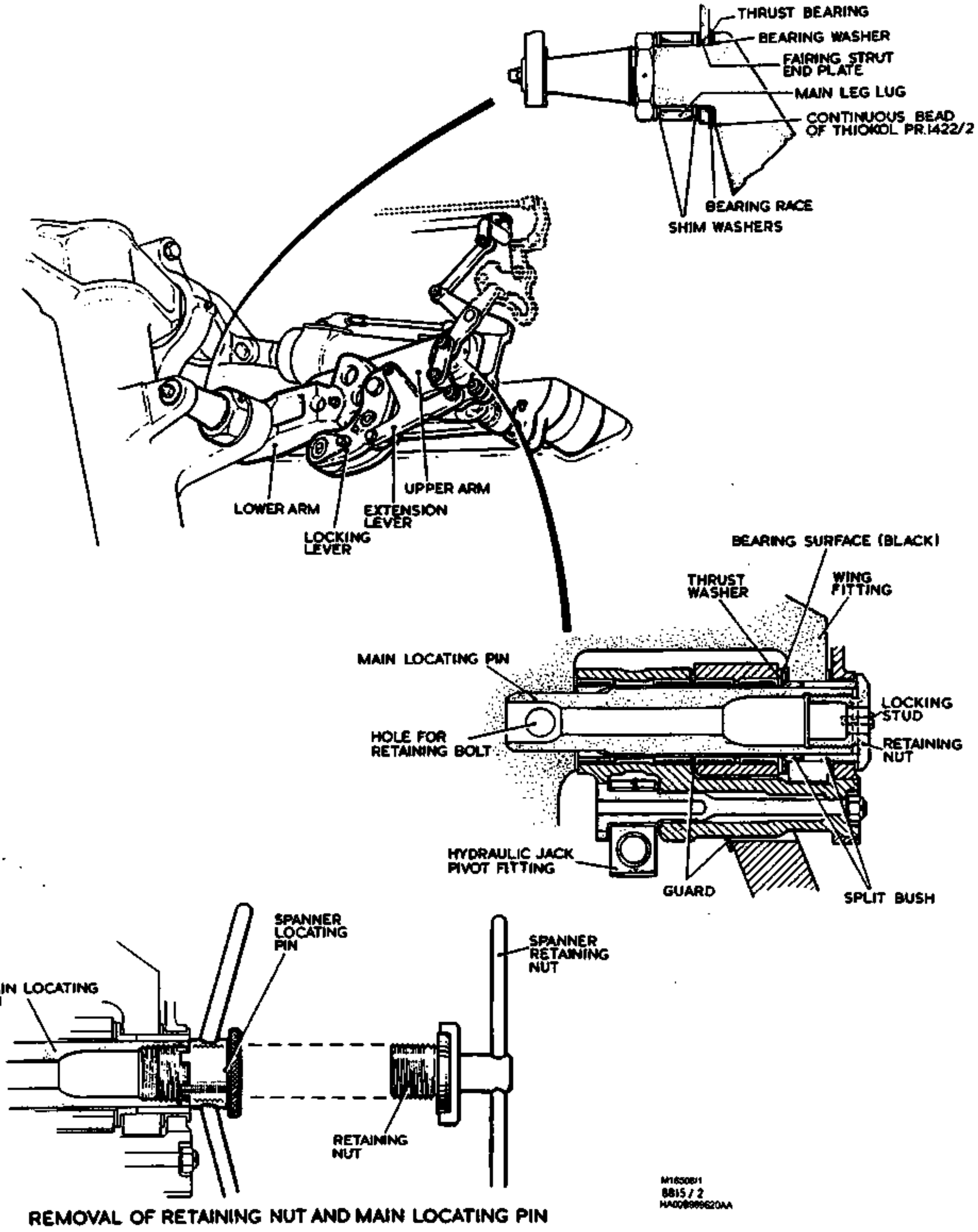
(7) Remove the retaining bolt at the forward end of the main locating pin and, use the special extractor to withdraw the pin. Support the side stay and remove the rear part of the split bush. Fold the stay assembly and move the upper arm clear of the wing fitting.

(8) Remove the nut that secures the lower arm of the side stay to the leg, and remove the stay assembly from the leg.

### B. Pre-Installation Checks *(Figure 402)*

**CAUTION: FINAL CHECKS AND ADJUSTMENTS MUST BE MADE, AFTER INSTALLATION, IN ACCORDANCE WITH ADJUSTMENT/TEST.**

(1) Visually inspect the bearing race and make sure that the offset lugs are not broken or damaged. If either one or both of the lugs are broken or damaged, replace the bearing race with a new item.



Side stay - removal and installation
*Figure 401*

(2) With the side stay held in the fully locked down position, make sure that there is a clearance between the roller and the end face of the cam on the lower arm, and between the roller and the upper arm casing.

(3) With the locking lever held in the fully unlocked position and the locking pin hard against the bottom of the side stay locking slot, fold the side stay assembly. Make sure that there is a clearance between the roller and the upper face of the cam on the lower arm (clearance C).

### C. Installation *(Figure 401)*

*NOTE: For routine lubrication refer to the Maintenance Schedule.*

(1) Assemble the thrust race and fairing strut end plate to the lower arm; seal the thrust race to the lower arm with a continuous bead of sealant (Item 314) in accordance with Chapter 20, SEALING OF PRESSURE CABINS. Assemble the lower arm to the leg, omitting the shim washers, and tighten the retaining nut.

(2) Make sure that the forward part of split bush is located in the wing pick-up fitting with the flange forward; position the upper arm in the wing fitting and install the main locating pin.

(3) Push the side stay assembly hard aft and the leg assembly both hard forward and hard outboard to take up accumulated clearances. Measure and note the gap on each side of the main leg lug.

(4) Remove the main locating pin at the upper arm and disconnect the lower arm from the leg.

(5) Lubricate all bearing surfaces with grease (Item 078).

(6) Assemble the side stay connection to the leg, install the shim washer packs on each side of the leg lug. Adjust the shims so that the total shim thickness on each side is 0.001 to 0.005 in. (pre Mod 251930: 0.003 in. to 0.005 in.) less than the corresponding gap measured in paragraph (3).

(7) Position the upper arm complete with the thrust washer, in the wing fitting.

*NOTE: Make sure that the bearing material (black surface) of the thrust washer is in contact with the flange of the bush in the wing fitting.*

(8) Assemble the rear part of the split bush into the wing fitting and locking lever.

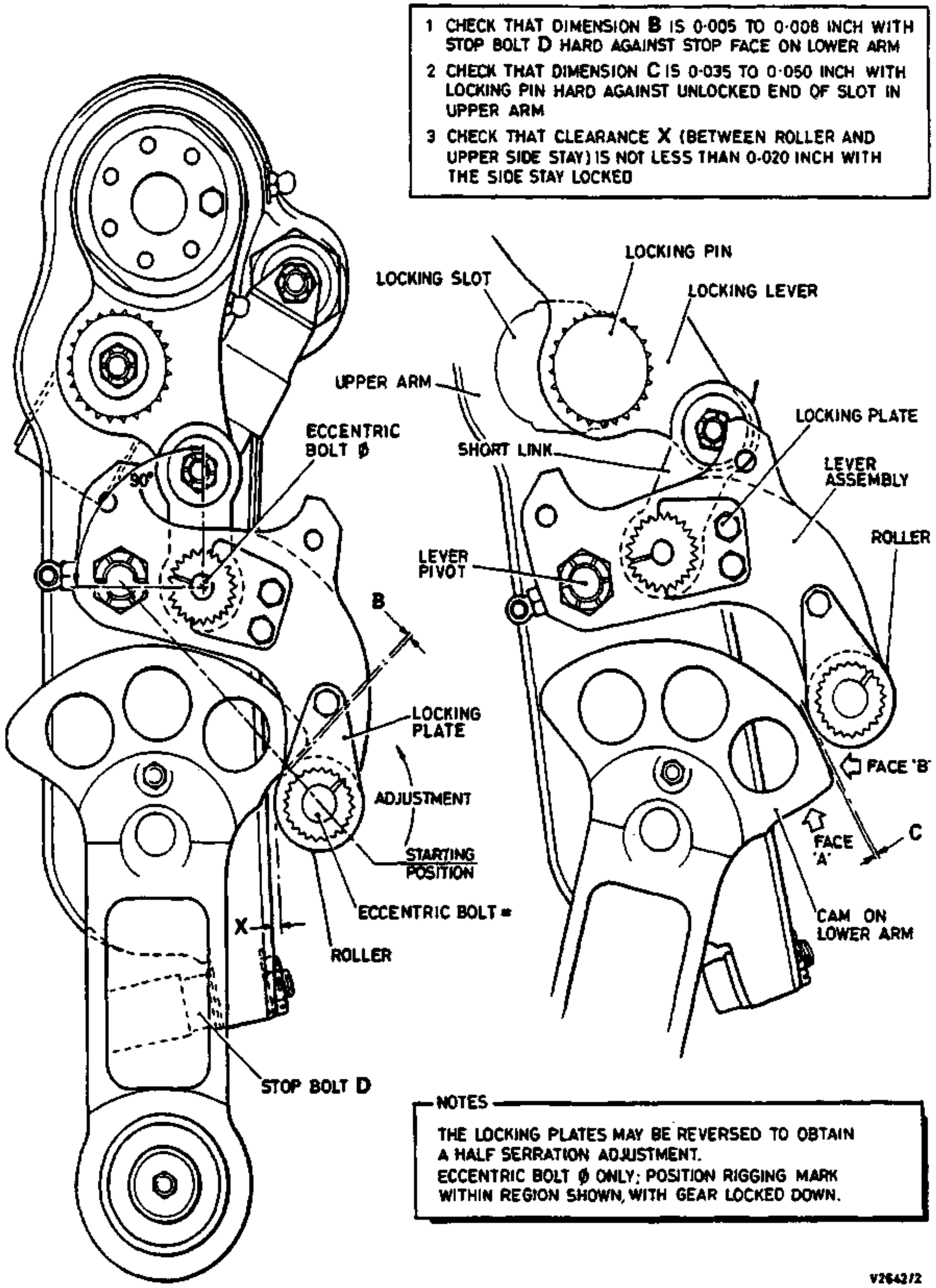
(9) Use the special extractor to insert the main locating pin and align the hole at the forward end of the pin with the hole in the wing fitting. Install the main pin retaining bolt and lock the nut with a new split pin.

(10) Install two bolts and distance peice between lever assembly and extension lever. Secure nuts with split pins.

(11) Using the special spanner install retaining nut at rear of main locating pin and install locking stud. Wirelock the stud to the retaining nut.

(12) Make sure that the eccentric bush in the side stay pivot fitting is located in the position noted during removal.

*NOTE: On the left-hand side stay, the pivot fitting must be located with the engraved arrow head and the flange of the eccentric bush on the upper side. On the right-hand side stay, the arrow head and flange must be on the lower side of the pivot fitting.*



1. CHECK THAT DIMENSION **B** IS 0·005 TO 0·008 INCH WITH STOP BOLT D HARD AGAINST STOP FACE ON LOWER ARM
2. CHECK THAT DIMENSION **C** IS 0·035 TO 0·050 INCH WITH LOCKING PIN HARD AGAINST UNLOCKED END OF SLOT IN UPPER ARM
3. CHECK THAT CLEARANCE **X** (BETWEEN ROLLER AND UPPER SIDE STAY) IS NOT LESS THAN 0·020 INCH WITH THE SIDE STAY LOCKED

NOTES
THE LOCKING PLATES MAY BE REVERSED TO OBTAIN A HALF SERRATION ADJUSTMENT.
ECCENTRIC BOLT Ø ONLY; POSITION RIGGING MARK WITHIN REGION SHOWN, WITH GEAR LOCKED DOWN.

Main gear - side stay clearances
*Figure 402*

(13) Connect the main gear jack to the side stay pivot fitting with the bolt (head on the lower side of the fitting), washer and nut. Tighten the nut and lock with a new split pin.

(14) Adjust the side stay clearances as necessary, in accordance with ADJUSTMENT/TEST.

(15) Adjust the fairing strut (MAIN GEAR FAIRINGS) and if necessary, the microswitches and mechanical indicating system (ELECTRICAL INDICATING SYSTEM and MECHANICAL INDICATING SYSTEM).

(16) Use a ground test rig and functionally test the landing gear (Chapter 29, MAIN SYSTEM - ADJUSTMENT/TEST).

## D. Close up

(1) Make sure the door jack clamp has been removed and the door manually closed.

(2) Lower airplane to ground (Chapter 7, JACKING AND TRESTLING).

(3) Make sure the work area is clean and clear of tools and micellaneous equipment.

# SIDE STAY ASSEMBLY - ADJUSTMENT/TEST

## 1. Side Stay Assembly *(Figure 402* REMOVAL/INSTALLATION, *Figures 501, 502, 503 and 504).*

| Equipment/Material | Part/Item No. |
|---|---|
| Grease | 078 (Chapter 20-95-11) |

### A. Adjust side stay clearances and reversing valve mechanism

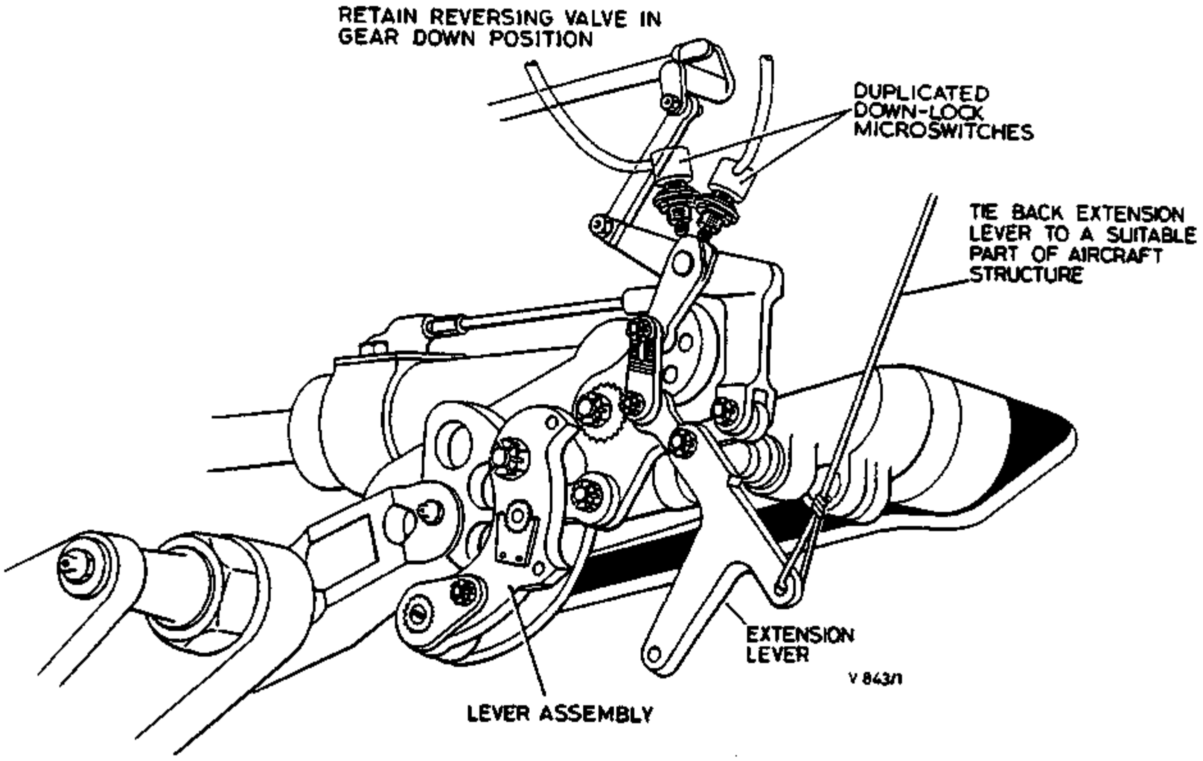
(1) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING)

(2) Lubricate the landing gear at all greasing points with grease (Item 078).

(3) Do one of the following operations:

(a) If the old side stay has been installed, or if the airplane is undergoing routine servicing checks, retract and lower the landing gear 5 times (Chapter 29, MAIN SYSTEM) to make sure that the side stay mechanism has 'bedded down'.

(b) If a new side stay has been installed, retract and lower the landing gear 25 times (Chapter 29, MAIN SYSTEM), to make sure that the side stay mechanism has 'bedded down'.


RETAIN REVERSING VALVE IN GEAR DOWN POSITION
DUPLICATED DOWN-LOCK MICROSWITCHES
TIE BACK EXTENSION LEVER TO A SUITABLE PART OF AIRCRAFT STRUCTURE
EXTENSION LEVER
V 843/1
LEVER ASSEMBLY

Disconnection of extension lever

*Figure 501*

(4) Lock the main gear down and release the hydraulic system pressure (Chapter 29, MAIN SYSTEM) and manually open the main gear door and install the door jack clamp.

(5) Temporarily disconnect the extension lever from the lever assembly, and tie back the extension lever to a suitable part of the airplane structure *(Figure 501)*

(6) At eccentric bolt # *(Figure 402,* REMOVAL/INSTALLATION*)* unlock and slacken the slotted nut until serrations on the bolt can be pushed clear of the locking plate. Rotate the eccentric bolt to increase the clearance between the roller and cam face 'A' to its maximum. (Rigging mark should now be at 90° to and pointing away from cam face 'A'). The eccentric bolt is now at the starting position.

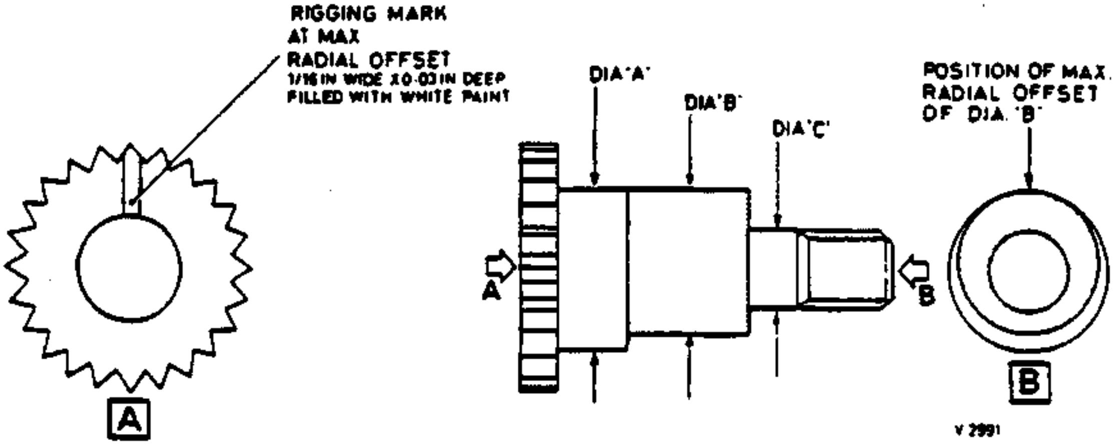
**CAUTION: DO NOT ADJUST STOP BOLT 'D'.**

(a) With stop bolt 'D' hard against the stop face on the lower arm, adjust the radial position of the eccentric bolt away from the starting position moving the rigging mark inboard to obtain dimension 'B' (0.005 to 0.008 in.)(0.127 to 0.203 mm) between cam face 'A' and roller.

(b) Tighten the slotted nut.

*NOTE: The locking plates of both eccentric bolts can be turned-over to give a half-serration adjustment.*

*NOTE: If head of eccentric bolts do not incorporate a rigging mark remove each bolt in turn and identify the radial position of the maximum offset of dia. 'B' from the concentric diameters 'A' and 'C' (refer to Figure 502). Add rigging marks to permanently identify this position and reinstall bolts.*



Rigging mark identification.
*Figure 502.*

(7) Remove the split pin and slacken the slotted nut attaching eccentric bolt Ø *(Figure 402,* REMOVAL/INSTALLATION*)* until the bolt can be pushed clear of the lockplate serrations. Make sure that the serrations are engaged before retracting leg.

(8) Operating on one leg at a time; with ground locking pin in the other side, select gear 'up' and slowly retract, using the airplane rear bay handpump until the side stay has unlocked and a hydraulic pressure of 300 to 500 psi is shown on the flight compartment gauge.

*NOTE: No additional external force must be applied to the side stay as this could increase the side stay clearances.*

*NOTE: Do not do the following checks and adjustments with the main gear in a condition other than that specified in paragraph (8), or with a hydraulic pressure in excess of 500 psi.*

(9) Make sure that the locking pin is hard against the unlocked end of the upper arm locking slot. Disengage the serrations from the locking plate and adjust the eccentric bolt Ø with rigging in range shown to obtain dimension 'C' (0.035 to 0.050 in.) (0.889 to 1.270 mm) between cam face 'B' and roller *(Figure 402,* REMOVAL/INSTALLATION*)*. Record the actual dimension.

(10) Select and pump the gear down until the side stay locks and make sure that clearance 'X' (not less than 0.020 in.) (0.508 mm) exists between the roller and the upper side stay. *(Figure 402,* REMOVAL/INSTALLATION).

(11) With both eccentric bolts fully engaged in their lockplates, tighten the nuts and lock with spilt pins.

(12) Reconnect the extension lever to the lever assembly and make sure that a nominal clearance of 0.050 in. (1.270 mm) exists between the reversing valve body and the flange of its plunger *(Figure 504)*. Adjust the connecting rod if necessary.

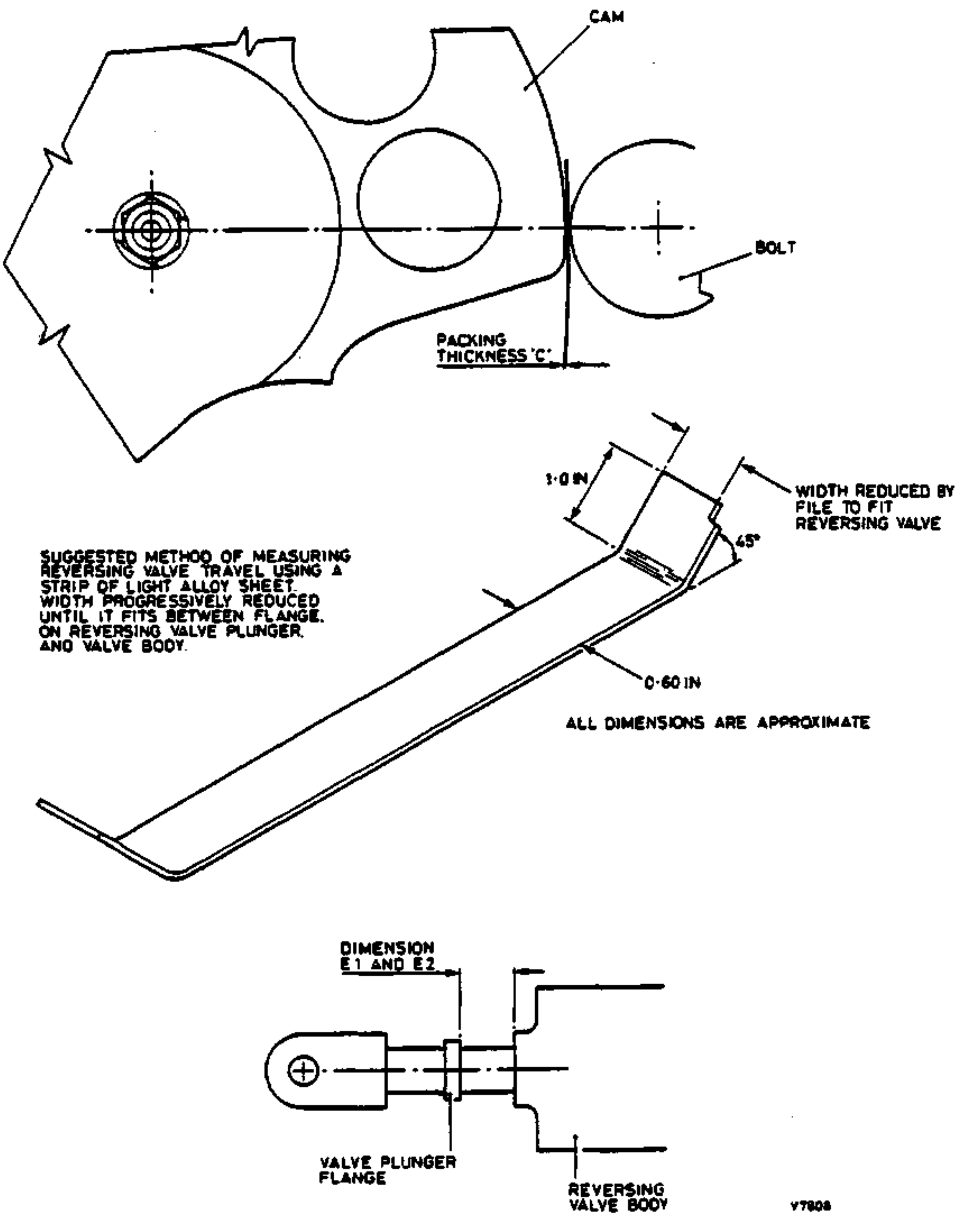
(13) Carefully remove the strapping securing the bonding lead to the leg fairing strut. Disconnect the fairing strut at the side stay end and unwrap the bonding lead, leave the lead connected at both ends.

**CAUTION: DURING LEG RETRACTION, MAKE SURE THAT THE FREE FORK FITTING ON THE LEG FROM WHICH THE FAIRING STRUT HAS BEEN DISCONNECTED, IS NOT CARRIED ROUND BY THE MOVEMENT OF THE SIDESTAY SO THAT IT POINTS UPWARDS WHEN THE LEG IS RETRACTED. IN THIS ATTITUDE THE UNDERCARRIAGE BAY TOP SHROUD COULD BE DAMAGED.**

**CAUTION: SUPPORT THE WEIGHT OF THE LEG FAIRING, BY HAND, TO AVOID STRAINING THE BONDING LEAD.**

(14) With the gear in the locked down position, make an 'UP' selection and operate the rear bay handpump until the sidestay is unlocked and the roller is just on the radial face of the cam as shown on *Figure 402,* REMOVAL/INSTALLATION. Insert packing of dimension 'C' between the roller and the cam face.

*NOTE: Packing can be inserted by placing it on the radial face of the cam and allowing the roller to roll over it.*



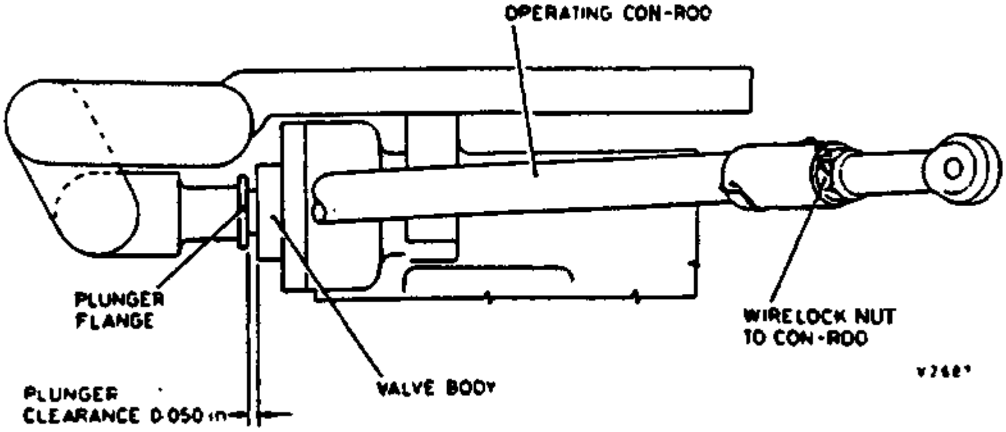
SUGGESTED METHOD OF MEASURING REVERSING VALVE TRAVEL USING A STRIP OF LIGHT ALLOY SHEET. WIDTH PROGRESSIVELY REDUCED UNTIL IT FITS BETWEEN FLANGE, ON REVERSING VALVE PLUNGER, AND VALVE BODY.

ALL DIMENSIONS ARE APPROXIMATE

Relative positions of side stay cam and flange of reversing plunger.
*Figure 503.*

(15) With the sidestay positioned as described in paragraph (13), accurately measure the extension of the reversing valve plunger and record as dimension (E1). Continue pumping until leg is fully 'UP' and the roller is just about to leave the radial face of the cam. With packing of dimension 'C' again inserted between the roller and the cam, again check the extension of the valve plunger. If this is greater than dimensions (E1) it must be measured and recorded as dimension (E2).

(16) Select and pump the gear 'down'. Reselect the gear 'up' and pump until the sidestay has unlocked. Remove the main gear door jack clamp. With physical pressure applied to the door, which tends to close the door, slowly extend the reversing valve plunger by raising the outboard end of the cranked lever pivoting on the wing fitting until the door starts to close. Accurately measure the plunger extension and record as dimension (F).



Reversing valve plunger adjustment
*Figure 504*

(17) The larger of the two dimensions (E1) and (E2) is to be used in the following calculations as (E):

- If dimension (F) minus (E) is greater than 0.030 in. (0.762 mm), the reversing valve rigging is satisfactory. Proceed to paragraph (17).
- If dimension (F) minus (E) is less than 0.030 in. (0.762 mm), disconnect and shorten the reversing valve operating con-rod by a half turn to achieve a dimension greater than 0.030 in. (0.762 mm). With the gear locked down, make sure that there is a minimum gap of 0.010 in. (0.254 mm) between the plunger flange and the body of the reversing valve.

(18) Select gear 'up' and slowly retract, using airplane rear bay hand pump. With gear locked 'up' make sure that the total extension of the reversing valve plunger is not more than 0.870 in. (2.210 mm).

NOTE: *If necessary, the 0.050 in. (0.127 mm) clearance (Figure 504) with the gear locked down may be reduced by shortening the reversing valve con-rod by a half turn to meet the 0.870 in.* (2.210 mm) *requirement, provided a minimum clearance of 0.010 in.* (0.254 mm) *is retained.*

(19) Wrap the bonding lead round the fairing strut and connect and lock the fairing connection. Replace the strapping.

(20) Use the airplane rear bay hand pump to function test each leg separately. Insert the locking pin in other leg.

(21) Do a check of the main gear down-lock electrical indicating system and mechanical indicating system. (ELECTRICAL INDICATING SYSTEM and MECHANICAL INDICATING SYSTEM).

(22) Do a check of all disturbed components for locking and safety.

(23) Release residual hydraulic pressure (Chapter 29, MAIN SYSTEM).

(24) Remove the main gear door jack clamps. Door will close when pressure is subsequently applied.

B. Connect the hydraulic ground test rig, remove the ground locking pins from the main and nose gear and functionally test the landing gear retraction/extension system (Chapter 29, MAIN SYSTEM).

**C. Close up**

(1) Lower airplane to ground (Chapter 7, JACKING AND TRESTLING).

(2) Make sure the work area is clean and clear of tools and micellaneous equipment.

# SIDE STAY ASSEMBLY - INSPECTION/CHECK

## 1. Side Stay Assembly

### A. Check sidestay assembly clearances and operation of reversing valve.

(1) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(2) Release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Make sure there is a minimum clearance of 0.020 in. between the lever assembly and locking lever with the side stay locked and unlocked.

(4) Make sure that clearance 'X' minimum dimension is maintained with the sidestay locked and unlocked (*Figure 402,* REMOVAL/INSTALLATION*)*.

(5) With main gear locked down, make sure that the following conditions exist:

  (a) The reversing valve is actuated to close main gear bay door.

  (b) There is 0.010 to 0.050 in. clearance between reversing valve plunger and valve body *(Figure 502,* ADJUSTMENT/TEST*)*.

(6) Use the airplane rear bay handpump to fully unlock the sidestay, make sure there is a gap of 0.005 in. between both downlock microswitch rollers and their cams.

### B. Examine the bearing race.

(1) Examine the bearing race for signs of damage.

*NOTE: If one of the two offset lugs on the bearing race is found to be damaged or broken it is permissible to continue operating until the next side stay removal, when the damaged item must be replaced. If both offset lugs are damaged or broken then you must replace the bearing race.*

### C. Close up

(1) Lower airplane to ground (Chapter 7, JACKING AND TRESTLING).

(2) Make sure the work area is clean and clear of tools and micellaneous equipment.

# MAIN GEAR FAIRINGS - MAINTENANCE PRACTICES

## 1. Removal/Installation

Equipment and materials required :-

| | | | | |
|---|---|---|---|---|
| Door jack clamp | .. | .. | .. | BAe 25Y1491A |
| Thiokol PR 1301 | .. | .. | .. | DTD 900/4523 |
| Grease | .. | .. | .. | DTD 5598 |

### A. Remove fairing

(1) With the main gear locked down, disconnect the fairing strut from its attachment on the fairing, and remove the fairing hinge bolts from the structure mounted eye bolts.

NOTE : The complete fairing strut assembly can only be removed or installed when the lower arm of the side stay is disconnected from the gear leg. Refer to Chapter 32, SIDE STAY ASSEMBLY.

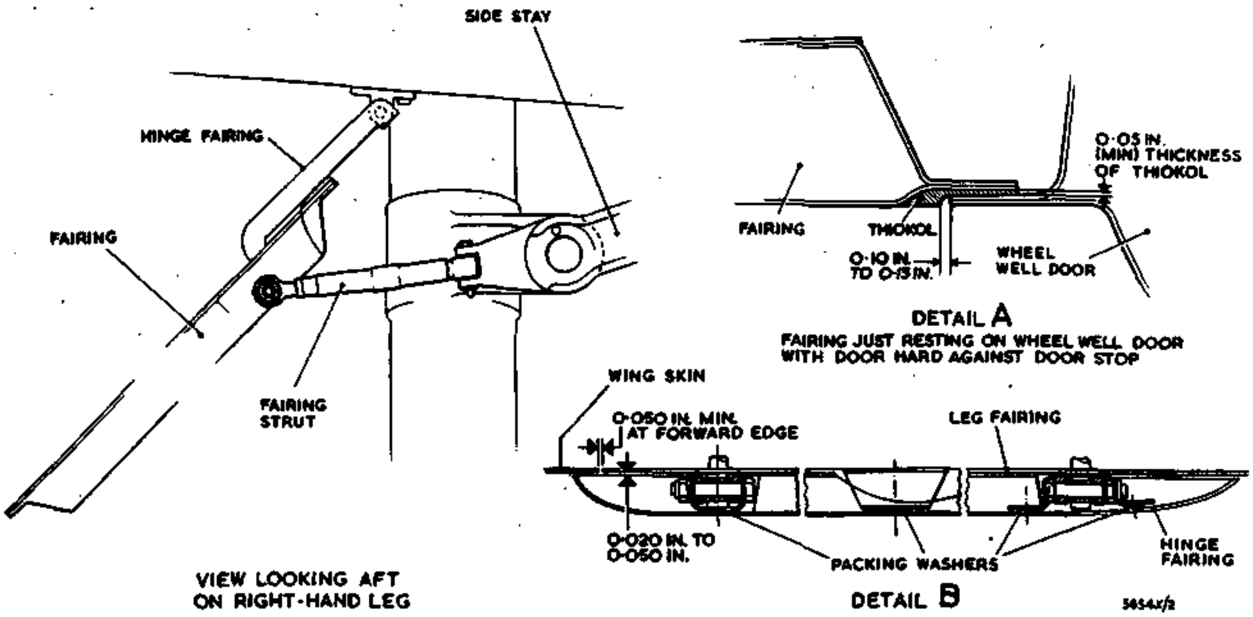
### B. Install fairing (Fig.201)

(1) Jack aircraft (see Chapter 7 - LIFTING AND SHORING).

(2) With the main gear locked down and the hydraulic system depressurized, open the wheel well door manually to its fullest extent. Fit door jack clamp on door jack ram.

(3) CAUTION : ENSURE THAT THE FAIRING STRUT DOES NOT FOUL THE AIRCRAFT STRUCTURE.

Using the aircraft ground servicing pump, retract the landing gear.



Main gear fairing installation
Fig.201

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(4) Lubricate fairing hinge bolts and eye-bolts with grease. Position fairing and fit hinge bolts, checking that a minimum clearance of 0.050 in. exists between the forward edge of the fairing and the wing skin (see Fig.201, Detail B). Secure hinge bolts with nuts and split pins. Mod.252092 : Check that a gap of 0.020 in. to 0.050 in. exists between hinge fairing and wing skin (see Fig.201, Detail B); adjust packing washers between hinge fairing and hinge brackets as necessary. Seal gap between hinge fairing and leg fairing with Thiokol PR1301 in accordance with BAe Spec S26-1002 (see Chapter 20), applying release agent to flange of hinge fairing.

(5) Connect the fairing strut to the fairing, if necessary, adjust length of strut until the fairing is flush with the outer wing skin. Check strut for safety but do not wire-lock the strut at this stage.

(6) Using the aircraft ground servicing pump, lower the landing gear. Release the hydraulic system pressure and remove the door jack clamp from the wheel well door.

(7) Using the aircraft ground servicing pump, raise the landing gear and check that, with the doors in the closed position, the lip on the fairing just contacts the lip on the wheel well door with the wheel well door hard against its stop. (Fig.201, Detail A). If necessary, adjust the length of the fairing strut until this condition is achieved.

(8) Wire-lock the fairing strut. Functionally test the door closing action by pressurizing the hydraulic system (Chapter 29, MAIN SYSTEM) and raising and lowering the landing gear and checking that the doors close without fouling.

(9) Lower aircraft and remove jacking equipment.

* * *

## MAIN GEAR WHEEL DOORS - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove main gear wheel doors

(1) With the main gear locked down and the wheel door closed, depressurise the hydraulic system (see Chapter 29, HYDRAULIC POWER).

(2) Manually open the door to its fullest extent. Remove the bolt securing the sequence valve linkage to the door hinge.

CAUTION : IT IS ESSENTIAL THAT THE SEQUENCE VALVE LINKAGE IS DISCONNECTED FROM THE DOOR BEFORE DISCONNECTING THE DOOR JACK, OTHERWISE THE LINKAGE OR THE VALVE MAY BE DAMAGED.

(3) Disconnect the door jack ram from the door fitting.

(4) Remove the bonding lead from the door rear hinge.

(5) Remove the door hinge bolts and then lower the door clear of the aircraft.

NOTE : Make certain the flanged bush in the front hinge casting is retained.

#### B. Install main gear wheel doors

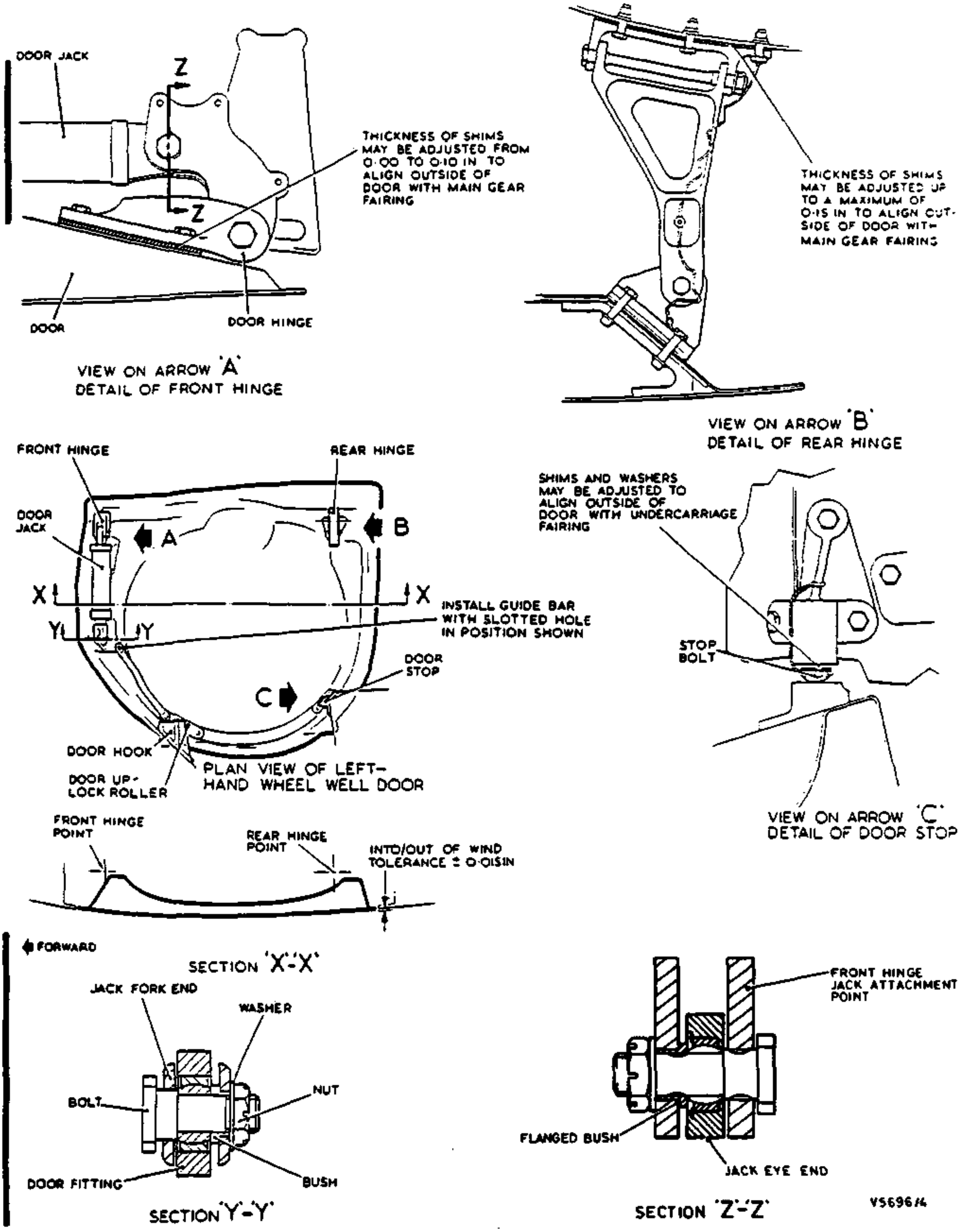
(1) Jack the aircraft (see Chapter 7, LIFTING AND SHORING).

(2) Position the door so that the door hinge fittings align with the front and rear hinges attached to the aircraft structure. Make sure the flanged bush is installed in the front hinge casting (inserted from between the forks of the casting), fit both hinge bolts, washers and nuts. Tighten and split pin the lock nuts.

(3) Connect the door jack ram to the door fitting making sure that the bush is correctly assembled in the jack fork (see Sec. Y-Y Fig.201). Install the connecting bolt and secure with the nut and split pin.

(4) Install and secure the bolt connecting the sequence valve linkage to the door hinge. With the door in the open position check the clearance between the sequence valve, plunger flange and body (see Chapter 32 SEQUENCE VALVE).

(5) Close the door manually and check that the inboard edge of the door skin aligns with the undercarriage fairing. If necessary, adjust the shims at the hinges to achieve the correct alignment (see Fig.201).


DOOR JACK
Z
Z
THICKNESS OF SHIMS MAY BE ADJUSTED FROM 0·00 TO 0·10 IN TO ALIGN OUTSIDE OF DOOR WITH MAIN GEAR FAIRING
DOOR
DOOR HINGE
VIEW ON ARROW 'A' DETAIL OF FRONT HINGE
THICKNESS OF SHIMS MAY BE ADJUSTED UP TO A MAXIMUM OF 0·15 IN TO ALIGN OUTSIDE OF DOOR WITH MAIN GEAR FAIRING
VIEW ON ARROW 'B' DETAIL OF REAR HINGE
FRONT HINGE
REAR HINGE
DOOR JACK
A
B
X
X
Y
Y
INSTALL GUIDE BAR WITH SLOTTED HOLE IN POSITION SHOWN
DOOR STOP
C
DOOR HOOK
DOOR UP-LOCK ROLLER
PLAN VIEW OF LEFT-HAND WHEEL WELL DOOR
SHIMS AND WASHERS MAY BE ADJUSTED TO ALIGN OUTSIDE OF DOOR WITH UNDERCARRIAGE FAIRING
STOP BOLT
VIEW ON ARROW 'C' DETAIL OF DOOR STOP
FRONT HINGE POINT
REAR HINGE POINT
INTO/OUT OF WIND TOLERANCE ± 0·015IN
FORWARD
SECTION 'X'-'X'
JACK FORK END
WASHER
BOLT
NUT
DOOR FITTING
BUSH
SECTION 'Y'-'Y'
FRONT HINGE JACK ATTACHMENT POINT
FLANGED BUSH
JACK EYE END
SECTION 'Z'-'Z'
V5696/4

Installation of wheel door
Fig.201

(6) Adjust the number and thickness of shim washers under the stop bolt head so that when the door is in the closed position, the door skin aligns with the undercarriage fairing (see Fig.201). Wire-lock the bolt to the bracket.

(7) Disconnect the leg fairing (see Chapter 32, MAIN GEAR FAIRINGS).

(8) With the wheel door closed and the main gear locked down, check and adjust the spring strut to achieve the correct clearance between the tip of the door hook and the up-lock roller (clearance X, Fig.202). Mod.252748, check minimum of 0.10 in. between the hook and local structure.

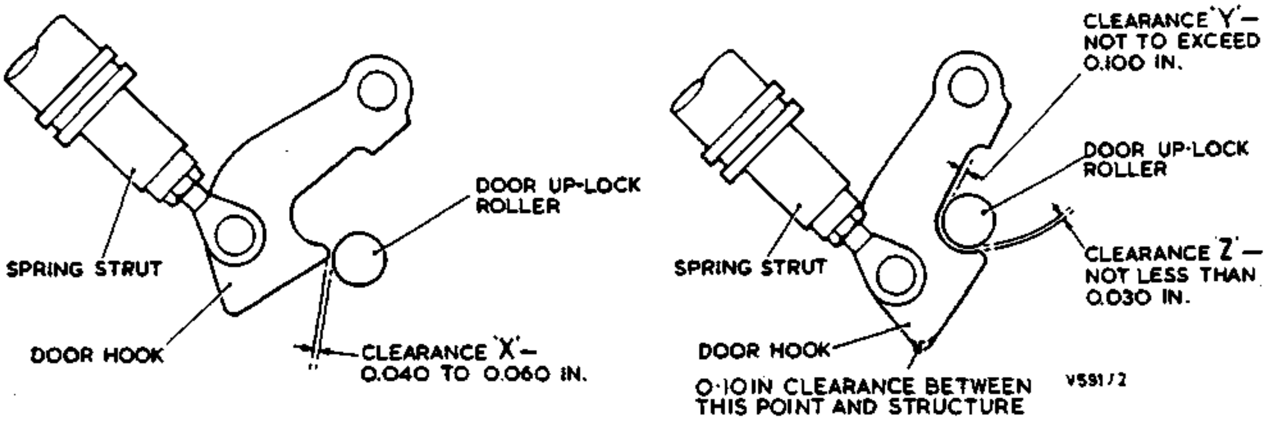
(9) Using the aircraft ground servicing pump, retract the landing gear, making sure that the fairing strut does not foul the aircraft structure.

(10) With the door hook correctly engaging the up-lock roller check the clearance between the hook and the side of the roller (clearance Y, Fig.202), and the clearance between the hook and the underside of the roller (clearance Z, Fig.202).

(11) Check that the into/out of wind tolerance between the door outer skin and the main gear fairing is within the limits shown on Fig.201.

(12) Lower the landing gear and check that the door is fully closed.

(13) Mod.252440 only, check that the up-lock spring latch and roller pin are engaged as shown on Fig.204. Adjust as necessary (see para.4.A., Adjustment/Test).


SPRING STRUT
DOOR HOOK
DOOR UP-LOCK ROLLER
CLEARANCE 'X'– 0.040 TO 0.060 IN.
CLEARANCE 'Y'– NOT TO EXCEED 0.100 IN.
DOOR UP-LOCK ROLLER
SPRING STRUT
CLEARANCE 'Z'– NOT LESS THAN 0.030 IN.
DOOR HOOK
0·10IN CLEARANCE BETWEEN THIS POINT AND STRUCTURE
VS91/2

Door hook to up-lock roller-clearances
Fig.202

(14) Reconnect the fairing strut (see Chapter 32, MAIN GEAR FAIRINGS).

(15) Adjust the door up-lock microswitch (see Chapter 32, ELECTRICAL INDICATING SYSTEM).

(16) Functionally test the landing gear (see Chapter 29, MAIN SYSTEM).

## 2. Removal/Installation of wheel door jack (applicable to LH and RH MLG doors)

### A. Remove wheel door jack

(1) With the main gear locked down and the wheel door closed, depressurise the hydraulic system (see Chapter 29, HYDRAULIC POWER).

(2) Display a warning notice prohibiting the use of hydraulic power.

(3) Manually open the door to its fullest extent.

(4) Position a receptacle to catch residual fluid.

(5) Remove the flexible hose connections from the jack adapters. Blank off the jack adapters and hose connections.

(6) Disconnect the door jack ram from the door fitting, retaining fixing items.

(7) Support the wheel door.

(8) Support the door jack and remove the jack attachment bolt from the door front hinge, withdraw the door jack.

NOTE : Make certain the flanged bush in the jack attachment point is retained.

### B. Install the wheel door jack

(1) Jack the aircraft (see Chapter 7, LIFTING AND SHORING).

NOTE : Make sure the correct handed jack is used for LH and RH wheel door.

(2) Lubricate the front hinge jack attachment point and the door fitting attachment point. Make certain the flanged bush is correctly assembled in the jack attachment point (See Sec. Z-Z, Fig.201). Install the jack to the door front hinge attachment point and secure with the bolt, washer and nut (retained at operation 2.A.(8)). Tighten the nut and install a new split pin.

(3) With the door jack on its retracted centres, remove the blanks. Remove the blank from the hydraulic hose with the smaller connector and install the hose to the smaller adapter on the jack. With the landing gear ground locking pins (3 off) installed and select landing gear up. Using the aircraft ground servicing handpump fully extend the jack (make sure that the extending ram does not contact the door). Loosen the connection and pump slowly until all air is expelled, tighten the adapter and wire lock. Connect the other hose to the jack and select landing gear down. Using the aircraft ground servicing handpump retract the jack. Loosen the connection and pump slowly until all air is expelled, tighten the adapter and wire lock. Select landing gear up and using the aircraft ground servicing handpump fully extend the jack.

(4) Connect the jack ram to the door fitting using items retained at operation 2.A.(6), make sure the bush is correctly assembled in the jack fork (see Sec. Y-Y, Fig.201), tighten the nut and install a new split pin.

(5) With subsequent down and up selections, close and open the door using the handpump until it operates smoothly. With the door closed, remove the appropriate landing gear ground locking pin and using the aircraft ground servicing handpump slowly retract the landing gear. Make sure that the door does not foul the aircraft structure. Check also that the into/out of wind tolerance between the door outer skin and the main gear fairing is within the limits shown on Fig.201. Check the door uplock roller clearances as shown on Fig.202.

(6) Lower the landing gear and make sure the door is fully closed.

(7) Remove warning notices displayed at operation 2.A.(2).

(8) Functionally test the landing gear (see Chapter 29, MAIN SYSTEM).

## 3. Removal/Installation of forward door hinge (Fig.203)

NOTE : On installation of hinge, fill gap between hinge and spar with packing 25WS3803/43.

CAUTION : TIGHTENING OF BOLTS MUST NOT BE A MEANS OF CLOSING GAP BETWEEN HINGE AND SPAR.

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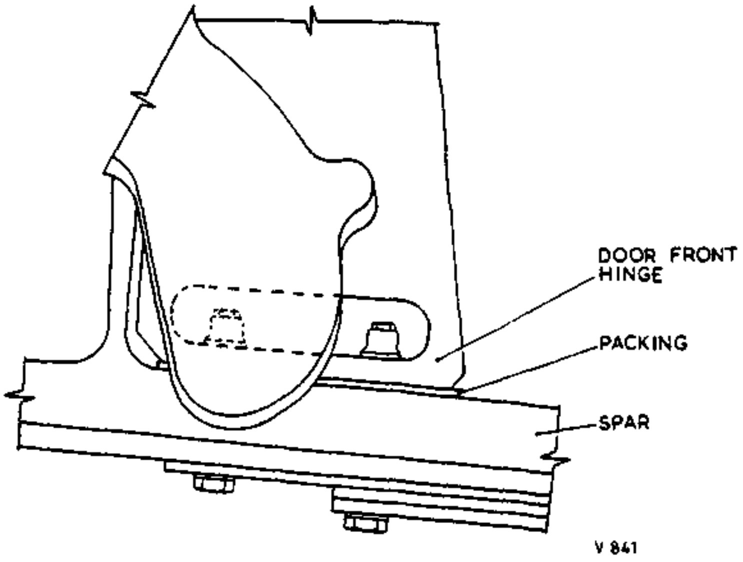
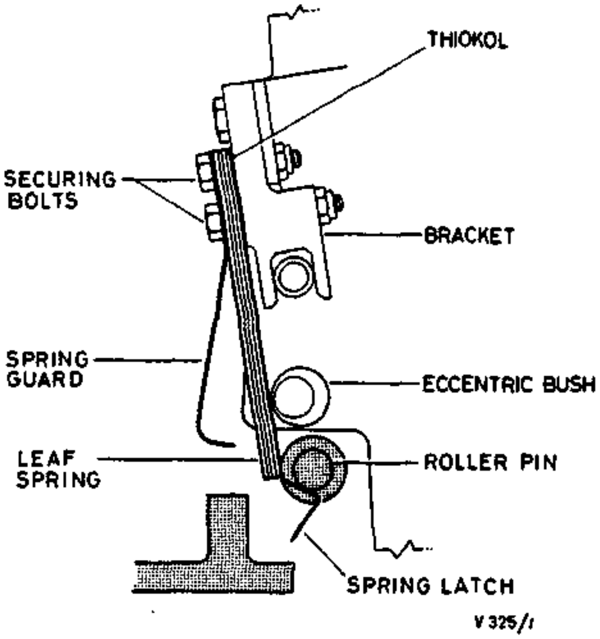


Forward hinge-to-spar packing
Fig.203



Up-lock spring latch installation
Fig.204

## 4. Adjustment/Test

### A. Adjust uplock spring latch (Mod.252440 only)

Material required:-

| | | |
|---|---|---|
| Genklene | .. | As required |
| Thiokol | .. | PR1422BT |

(1) Jack the aircraft (see Chapter 7, LIFTING AND SHORING).

(2) Depressurise the hydraulic system (see Chapter 29, MAIN SYSTEM) and manually lower the door.

(3) Remove the bolts securing the spring latch assembly to the bracket of the main gear door uplock assembly and remove the latch assembly.

(4) Using Genklene or other suitable solvent, clean off all traces of Thiokol from the parting faces of the bracket for the door uplock assembly and the spring latch assembly.

(5) Remove the split pin, nut and eccentric bush and thoroughly clean off all traces of Thiokol from the bush and its seating on the mounting casting.

(6) Apply new Thiokol to the parting face and to the seating face of the eccentric bush on the mounting casting in accordance with Chapter 20-10-1002.

(7) Install the spring latch assembly and insert but do not fully tighten the securing bolts at this stage (lightly clamped but free to slide).

(8) Assemble the eccentric bush and slotted nut to its bolt, do not tighten the nut.

(9) With the door fully closed, positionally adjust the spring latch and the eccentric bush to give the pin engagement shown on Fig.204.

(10) Tighten the spring latch securing bolts and the nut securing the eccentric bush, make sure the bush does not turn, and finally lock the nut with a split pin.

(11) Remove the ground locking pins and using a hydraulic power rig raise and lower the landing gear a few times to check that the door is locked by the spring latch each time the door closes.

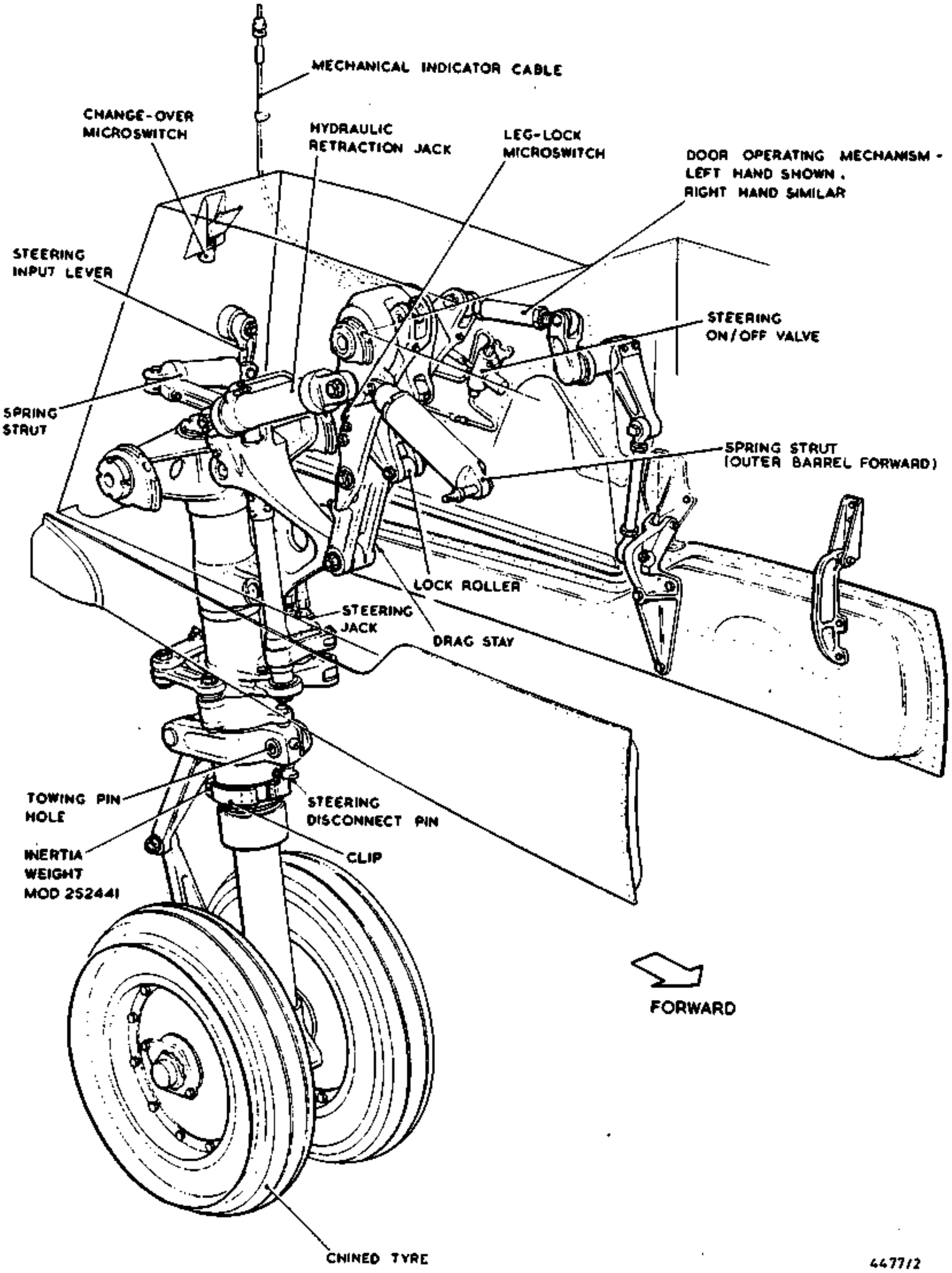
(12) Fit the ground locking pins.

(13) Lower the aircraft on to its wheels.

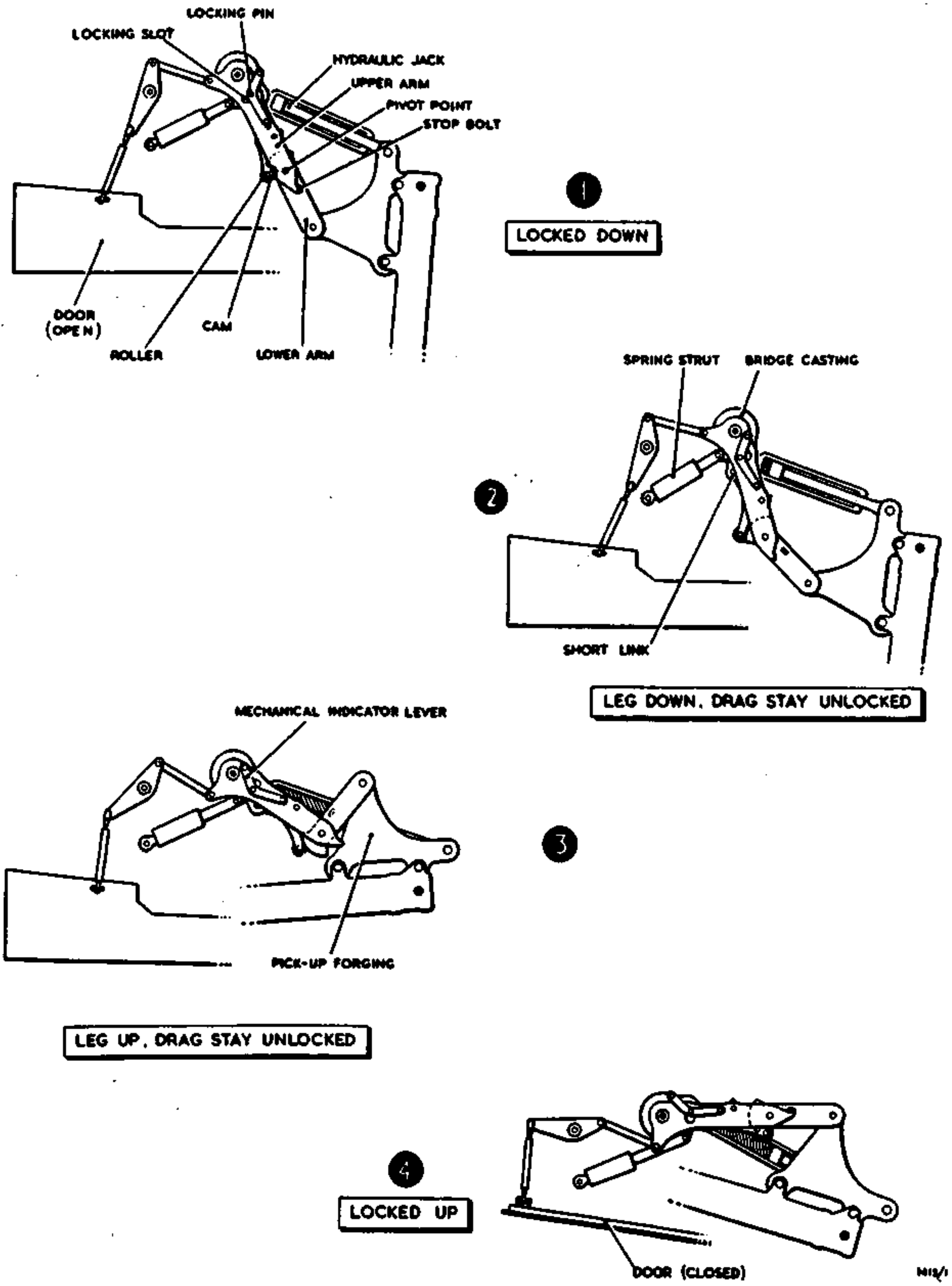
# NOSE GEAR AND DOORS - DESCRIPTION AND OPERATION

## 1. Description (Fig.1)

The self-centring nose leg assembly incorporates an oleo-pneumatic shock absorber strut, the base of which carries a twin live axle.



Nose landing gear
Fig.1



Nose gear retraction sequence
Fig.2

The leg is mounted in bearings attached to fittings on each side of the nose gear bay and is stabilized in the down position by a drag stay assembly which folds during retraction and forms the main locking component in both the extended and retracted positions.

Two hinged doors, linked to the retraction mechanism, enclose the gear in the retracted position.

After incorporation of Mod.252441, any tendency for the nose wheels to shimmy is minimized by an inertia weight. (Fig.1).

## 2.Operation (Fig.2)

### A.Retraction

With the landing gear down, the stops on each side of the drag stay upper arm contact the stop bolts on the lower arm, the locking pin is held against one end of the locking slots and the roller is engaged on the end face of the cam on the lower arm. In this position, the pivot point of the drag stay is over-centre in relation to the upper and lower stay connections, so forming a geometric lock; opposition to unlocking of the roller lever is provided by an over-centre condition at a short link.

When the landing gear is selected up, the first movement of the jack body rotates the bridge casting against the loading of the spring strut; this causes the short link to move the roller lever and disengage the roller from the end face of the cam on the lower arm. At the same time, the locking pin is moved to the other end of the locking slots; further movement of the jack folds the drag stay, and the leg is retracted by the force applied to the drag stay pick-up at the top of the leg assembly.

When retraction is nearly completed, the drag stay straightens again, being pulled into position by the leg. Final movement of the drag stay operates the door mechanism to close the doors. Due to the rotation of the bridge casting, the final movement of the jack moves the locking pin to the locked end of the slots and operates the roller lever to engage the roller on the end face of the cam on the lower arm. The drag stay components are now in the same relative position as when the gear is locked down; the spring strut ensures that the lock is maintained, up or down, when hydraulic pressure is removed from the jack.

### B.Extension

Extension is the reverse of retraction. The jack retracts, rotates the bridge casting, the roller moves from the cam face and the lock is broken. The gear extends, drag stay movement opens the doors, the drag stay folds and then straightens, the bridge casting is rotated, the locking pin moves in the slot, roller engages and the down lock is made.

* * *

# NOSE LEG ASSEMBLY - MAINTENANCE PRACTICES

## 1. Unit servicing

### A. Lubrication

For routine lubrication data, refer to the Maintenance Schedule.

### B. Check nitrogen pressure in leg

Refer to Chapter 12, SERVICING - LANDING GEAR.

### C. Fill leg with hydraulic fluid (airplane not on jacks)

| Equipment/Material | Part/Item No. |
|---|---|
| Adapter | 25Y759A |
| Hydraulic fluid | 107 (Chapter 20-95-101) |
| Silicone grease | 046 (Chapter 20-95-11) |

(1) Install the gear locking pins.

(2) Protect the wheels and tires from spilt fluid.

**WARNING: BE CAREFUL WHEN RELEASING PRESSURIZED NITROGEN FROM THE LEG. RELEASE THE PRESSURE SLOWLY, A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY, PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.**

**CAUTION: FAILURE TO RELEASE THE PRESSURE SLOWLY MAY RESULT IN DAMAGE TO THE SHOCK ABSORBER STRUT INTERNAL STOPS.**

(3) Slowly release the nitrogen pressure from the leg through the charging adapter and make sure the shock absorber strut is fully bottomed.

(4) Remove the locking plate and then unscrew and remove the nitrogen charging valve from the shock absorber strut.

(5) Gain access to the bleed screws at the top of the leg. Remove one bleed screw and connect the pump adapter in its place.

(6) Remove the remaining bleed screw and, in its place, attach a suitable length of tubing. Lead the free end of the tube into a clean oil container.

(7) Pump in hydraulic fluid (Item 107) until all gas is expelled and there is a gas-free flow of fluid from the tubing.

**CAUTION: DO NOT OVERTIGHTEN THE BLEED SCREWS AS THIS CAN CAUSE DISTORTION OF THE PRESSURE HEAD.**

(8) Liberally coat both bleed screws with silicone grease (Item 046). Remove the tubing, install and tighten one of the bleed screws to the open bleed screw hole.

(9) Continue to pump hydraulic fluid into the strut until a maximum pressure of 200 psi. is reached, this will make sure that the separator piston is forced to the bottom of the plunger tube. Stop pumping and make sure that the strut holds this pressure for a minimum of two minutes.

NOTE: *Failure to hold this pressure indicates leakage from the pump unit or strut and both should be examined for such. If there is no evidence of leakage, the drop in pressure is probably because the separator piston has continued to 'creep' to its 'bottomed' position, because of the relatively low pressure applied.*

(10) Continue to pump hydraulic fluid slowly into the strut (maximum pressure 200 psi.) until a steady pressure is achieved; it may then be concluded that the piston has 'bottomed'.

(11) Release the pressure, disconnect the pump and adapter and install the remaining bleed screw.

(12) Install a new O-ring seal to the charging valve and screw the valve into its adapter. Install the locking plate.

(13) Pressurize the leg with nitrogen (Chapter 12, SERVICING - LANDING GEAR) to extend the shock absorber strut and to raise the airplane to its normal attitude.

(14) Make sure all disturbed connections are locked.

(15) Remove the gear locking pins.

## 2. Removal/Installation

| Equipment/Materials | Part/Item No. |
|---|---|
| Grease | 078 (Chapter 20-95-11) |

### A. Remove leg assembly

NOTE: *Install blanks to all disconnected hydraulic components and pipe connectors.*

(1) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING).

(2) Release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Remove the wheels (Chapter 32, NOSE WHEEL).

(4) Disconnect the nose wheel steering mechanism at the spring strut.

(5) Disconnect the hydraulic connections to the nose wheel steering jack.

(6) Disconnect the drag stay and the hydraulic retraction jack at the leg pick-up forging.

(7) Support the leg assembly, remove the bearing block securing bolts and remove the leg assembly.

**B. Install leg assembly**

*NOTE: Remove blanks from hydraulic components and pipe connectors.*

(1) Make sure the fluid level in the leg is correct and is pressurized with nitrogen to the correct pressure (Paragraph 1.C. and Chapter 12, SERVICING - LANDING GEAR).

(2) Lubricate the leg assembly bearings with grease (Item 078). Install bolts securing bearing blocks to fittings on nose gear bay side walls.

(3) Connect the retraction jack and drag stay to the leg pick-up forging. Make sure the pin in the mechanical indicator lever, pivoted to the drag stay, engages in the mechanical indicator fork.

(4) Make hydraulic connections to the steering servo unit and connect the nosewheel steering mechanism at the spring strut.

(5) Install the nose wheels (Chapter 32, NOSE WHEELS).

(6) Disconnect the nose gear doors and retract the nose gear. Make sure there is no fouling of the nose gear steering hoses with the structure or leg mechanism. Lower the nose gear and reconnect the nose gear doors to the operating struts, split pin the securing nuts.

(7) Adjust and mechanically test the nose wheel steering and the nose gear mechanical indicating systems (Chapter 32, STEERING and MECHANICAL INDICATING SYSTEM respectively).

(8) Do a functional test of the landing gear (Chapter 29, MAIN SYSTEM).

(9) Make sure all disturbed connections are locked.

(10) Lower the airplane (Chapter 7, LIFTING AND SHORING).

## 3. Replace gland seals in situ *(Figure 201)*

| Equipment/Material | Part/Item No. |
|---|---|
| Spanner, axle retaining nut | 25Y239A |
| Spanner, gland retaining nut | 25Y237A |
| De-greasing agent | 230 (Chapter 20-95-201) |
| Sealing compound | 314 (Chapter 20-95-301) |
| Hydraulic fluid | 107 (Chapter 20-95-101) |

**A. Procedure**

(1) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING).

(2) Remove the nose wheels (Chapter 32, NOSE WHEELS).

**WARNING: BE CAREFUL WHEN RELEASING PRESSURIZED NITROGEN FROM THE LEG. RELEASE THE PRESSURE SLOWLY, A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY, PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.**

**WARNING: FAILURE TO RELEASE THE PRESSURE FROM A LEG WITH A FAULTY SEPARATOR SEAL MAY RESULT IN PERSONAL INJURY DURING SUBSEQUENT DISASSEMBLY.**

(3) Slowly release the nitrogen pressure from the leg through the charging adaptor.

(4) Remove one of the two bleed screws at the top of the leg to release any nitrogen pressure that may be present due to leakage past the separator. Faulty separator seals must be changed in accordance with instructions in the CMM.

(5) Disconnect the upper torque link by removing the nut, bolt and pin.

(6) Remove the locking bolt and then unscrew the axle retaining nut, using special spanner.

(7) Remove the locking tab and unscrew the adapter, complete with charging valve, from the leg.

(8) Separate the axle assembly from the plunger tube. Remove any sealing compound adhering to the plunger tube, taking care not to damage the chrome plate.

(9) Partially retract the leg and support it at a suitable angle, make provision for spilt hydraulic fluid.

(10) Remove the bolt which locks the gland retaining nut and, using the special spanner, unscrew and remove the retaining nut.

(11) Remove the spacer ring and the scraper ring. Hook out and remove the gland seal.

**CAUTION: MAKE SURE THAT THE GLAND SEAL IS INSTALLED CORRECTLY WITH THE RUBBER/FABRIC FACE DOWNWARDS.**

(12) Install a new gland seal. Assemble the seal with hydraulic fluid. Examine the scraper ring and renew as necessary. Install the spacer and scraper ring.

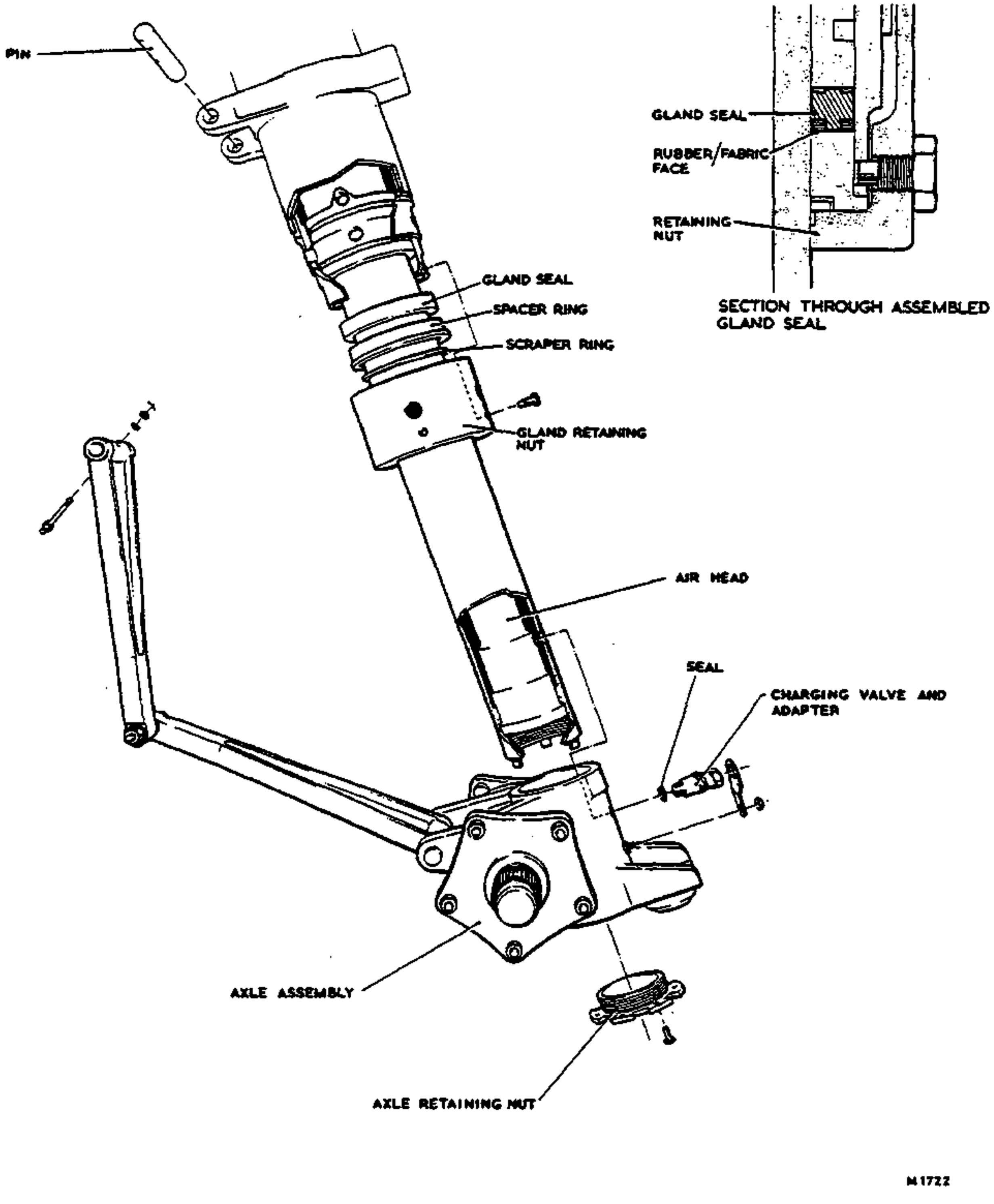
(13) Screw on the gland retaining nut, tighten using the special spanner. Lock with the bolt and wire-lock the bolt to the retaining nut. Clean off excess fluid.

(14) Slide the axle assembly onto the plunger tube, locating the dogs on the plunger tube with the slots in the axle. Make sure that the holes in the axle, plunger tube and the air head are aligned. Install a new sealing ring and screw in the adapter complete with charging valve. Install the locking tab; secure the tab with the nut.

(15) Install the retaining nut to the plunger tube and tighten with the special spanner. Lock with the bolt and wire-lock the bolt to the retaining nut.

(16) Insert the pin to connect the torque link to the upper casing and lock with the bolt, washer, nut and split pin.

(17) Extend and lock the leg down.



Seal removal and installation

*Figure 201*

(18) Make sure the fluid level in the leg is correct and is pressurized with nitrogen to the correct pressure (Paragraph 1.C. and Chapter 12, SERVICING).

(19) Clean joints with de-greasing agent (Item 230) and apply a fillet of sealing compound (Item 314) to the joint between the plunger tube and the axle barrel and around the nitrogen charging valve adapter.

(20) Install the nose wheels (Chapter 32, NOSE WHEELS).

(21) Make sure all disturbed connections are locked.

(22) Lower the airplane (Chapter 7, LIFTING AND SHORING).

## 4. Replace equi-flex scraper ring *(Figure 202)*

| Equipment/Material | Part/Item No. |
|---|---|
| Sharp knife or razor blade | Local supply |
| Hydraulic fluid | 107 (Chapter 20-95-101) |

### A. Procedure

(1) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING).

(2) Remove the nose wheels (Chapter 32, NOSE WHEEL).

**WARNING: BE CAREFUL WHEN RELEASING PRESSURIZED NITROGEN FROM THE LEG. RELEASE THE PRESSURE SLOWLY, A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY, PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING.**

**WARNING: FAILURE TO RELEASE THE PRESSURE FROM A LEG WITH A FAULTY SEPARATOR SEAL MAY RESULT IN PERSONAL INJURY DURING SUBSEQUENT DISASSEMBLY.**

(3) Slowly release the nitrogen pressure from the leg through the charging adaptor.

(4) Dismantle the leg in accordance with paragraphs 3.A.(4) to 3.A.(11).

(5) Withdraw the scraper ring.

(6) Use a sharp knife or razor blade and cut through the scraper ring elastomer, discard elastomer.

*NOTE: If it is intended to change the elastomer only, ignore paragraphs (7) and (10).*

(7) Prise open the scraper element and unwind it from the tube.

(8) Clean the scraper ring seating.

**CAUTION: SLICE THE ELASTOMER CLEANLY.**

(9) Use a sharp knife or razor blade and carefully cut through the elastomer of the serviceable scraper ring.

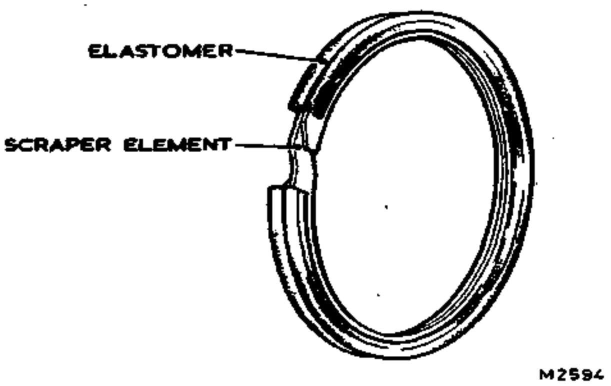
(10) Prise open the new scraper element and wind it onto the plunger tube.

(11) Lubricate the scraper element and elastomer with hydraulic fluid.

(12) Position elastomer on the scraper element.

(13) Insert the scraper ring into the recess in the spacer ring.

(14) Re-assemble and service the leg in accordance with paragraphs 3.A.(12) to 3.A.(22).



Equi-flex wiper ring
*Figure 202*

# DRAG STAY ASSEMBLY - MAINTENANCE PRACTICES

## 1. Drag stay assembly.

### A. Removal.

(1) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(2) Release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Disconnect the door operating struts at the upper arms.

(4) Isolate the electrical circuit (Chapter 24, GENERAL) and remove the leg-lock microswitch.

(5) Remove the bolt attaching the lower arm to the leg pick-up forging.

(6) Support the assembly; remove the bolts securing the end fittings to the pick-up fittings on the nose gear bay side walls.

(7) Disconnect the hydraulic retraction actuator at the bridge casting.

**WARNING: AT ITS INSTALLED LENGTH THE SPRING STRUT EXERTS A FORCE OF APPROXIMATELY 50 LB.**

(8) Disconnect the spring strut at its forward attachment.

(9) Remove the drag stay assembly.

### B. Installation *(Figure 201).*

| Equipment/Materials | Part/Item No. |
|---|---|
| Grease | 078 (Chapter 20-95-11) |

(1) Do a drag stay adjustment check (paragraph 1.C.).

(2) Connect and lock the hydraulic retraction actuator to the bridge casting.

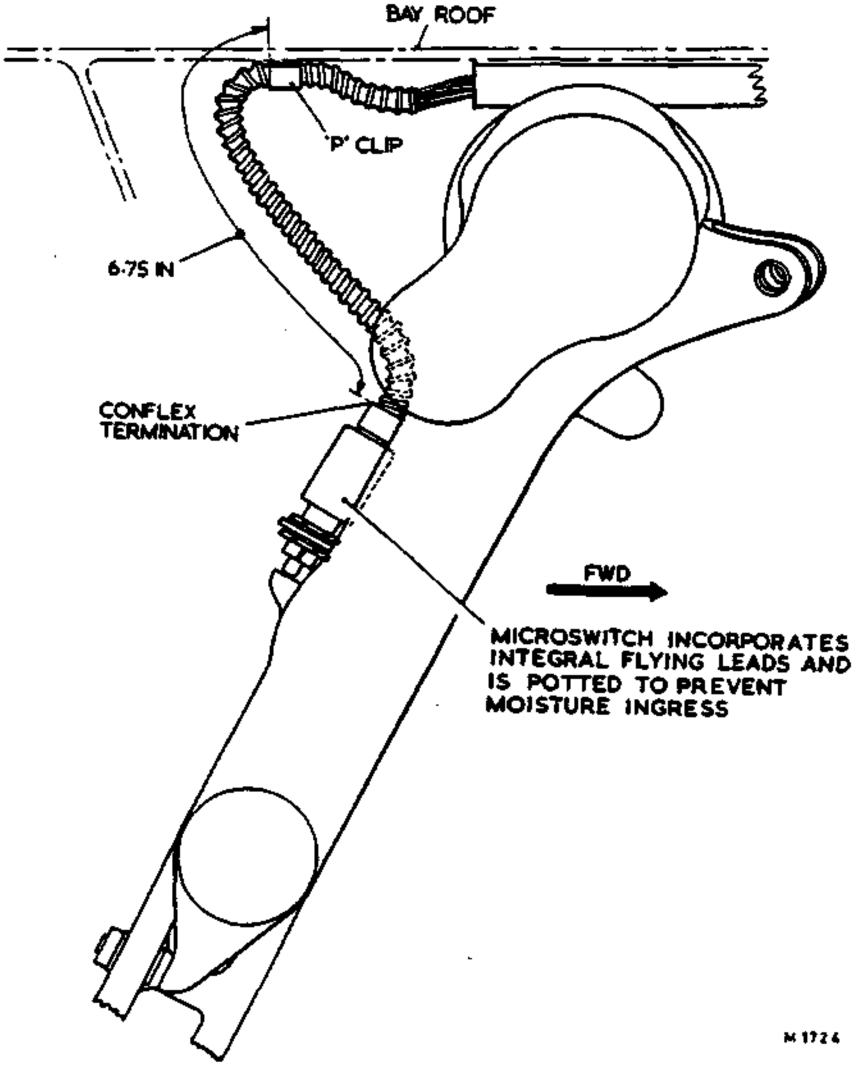
**CAUTION: IF THE SPRING STRUT HAS BEEN COMPLETELY REMOVED MAKE SURE IT IS INSTALLED CORRECTLY WITH THE OUTER BARREL FORWARD, AS INCORRECT INSTALLATION MAY CAUSE CLEARANCE PROBLEMS (NOSE GEAR DOORS).**

(3) Connect and lock the spring strut (outer barrel forward) to the forward attachment point on the nose gear bay structure.

(4) Bolt the top end fittings to the pick-up fittings on the nose gear bay side walls and connect the lower arm to the leg pick-up forging. Split pin all nuts. Lubricate all bearing surfaces with grease (Item 078).

(5) Install the leg-lock microswitch and close the circuit breaker (opened in paragraph 1.A. (5)).

NOTE: *Mod.251781. When installing the microswitch it is important that the electrical cable Conflex tubing is positioned in the P-clip so that the distance along the Conflex, between the edge of the P-clip and the Conflex termination on the microswitch, is 6.75 in. (Figure 201).*


BAY ROOF
'P' CLIP
6.75 IN
CONFLEX TERMINATION
FWD
MICROSWITCH INCORPORATES INTEGRAL FLYING LEADS AND IS POTTED TO PREVENT MOISTURE INGRESS
M 1724

Leg lock microswitch cable adjustment

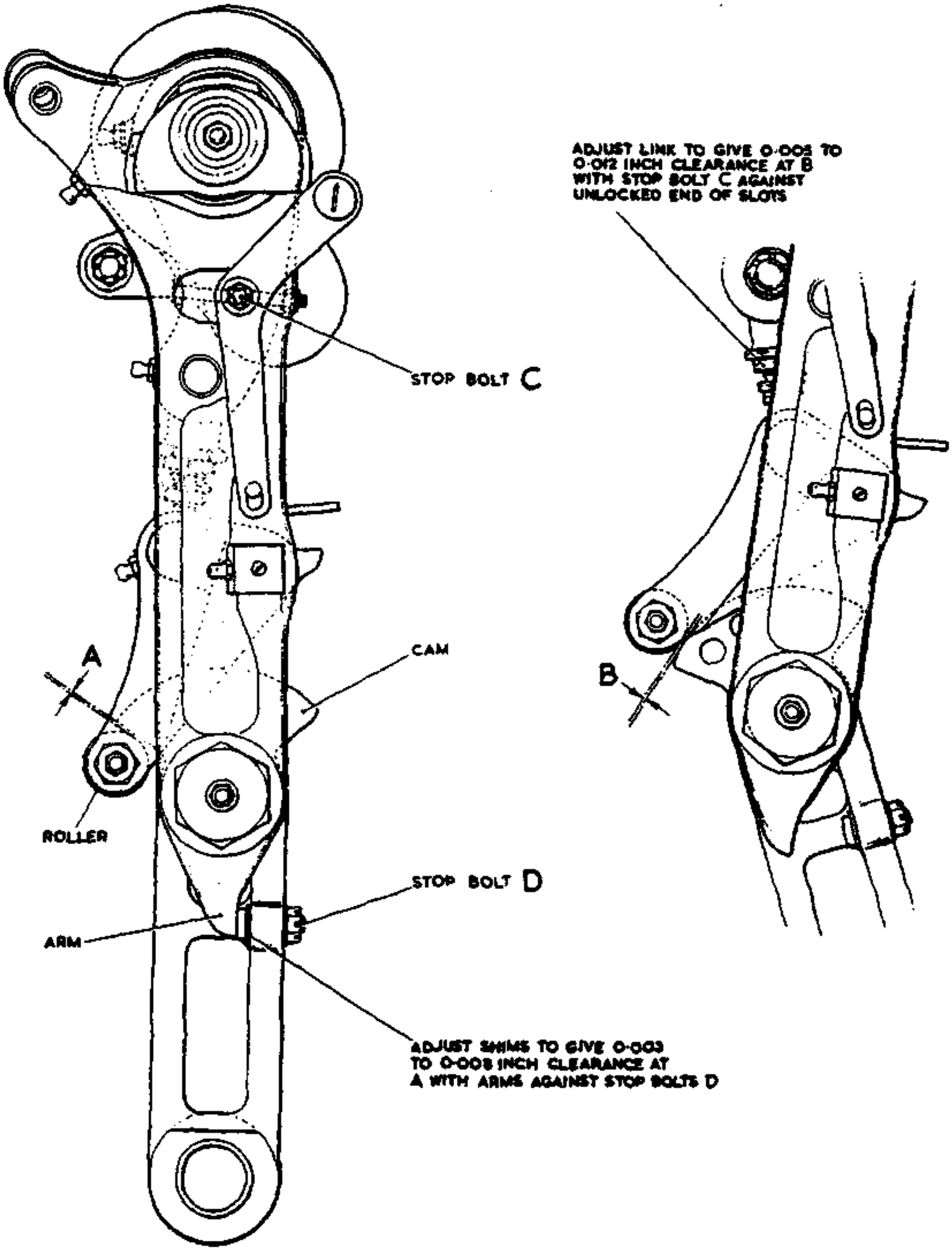
*Figure 201*

(6) Connect the door operating struts and rig the door operating mechanism (NOSE GEAR DOORS).

**CAUTION: MAKE SURE THAT THE BOLTS SECURING THE DOOR OPERATING STRUT TO THE DRAG STAY ARE ASSEMBLED WITH THE BOLT HEADS INBOARD.**

(7) Adjust the microswitches and the mechanical indicating system (ELECTRICAL INDICATING SYSTEM and MECHANICAL INDICATING SYSTEM).

(8) Functionally test the landing gear (Chapter 29, MAIN SYSTEM ).



ADJUST LINK TO GIVE 0·005 TO 0·012 INCH CLEARANCE AT B WITH STOP BOLT C AGAINST UNLOCKED END OF SLOTS

ADJUST SHIMS TO GIVE 0·003 TO 0·008 INCH CLEARANCE AT A WITH ARMS AGAINST STOP BOLTS D

Nose gear drag stay adjustments.

*Figure 202*

M1723

**C. Adjustment/Test** *(Figure 202).*

(1) With the drag stay fully locked, do a check of the clearance between the roller and the end face of the cam on the lower arm (clearance A). Adjust shims under the stop bolt to obtain this clearance, split pin lock the stop bolt.

(2) With the locking lever held to the fully unlocked position and the locking pin hard against the end of the slots in the upper arms, fold the drag stay assembly. Do a check of the clearance between the roller and the upper face of the cam on the lower arm (clearance B). Adjust the length of the short link to obtain this clearance.

(3) Make sure that the short link ends are in safety and wire lock.

**D. Lubrication.**

(1) For routine lubrication data, refer to the Maintenance Schedule.

**E. Check the drag stay clearance** *(Figure 202).*

(1) Remove the nose gear ground locking pin.

(2) Make sure the ground locking pins are installed to the main gear.

(3) Select the gear up and do a retraction of the nose gear using the hand pump situated in the rear equipment bay.

(4) Select the gear down and pump until the nose gear is down and locked.

(5) Make sure the hydraulic system is pressurized. Check the clearance between the roller and the end face of the cam on the lower arm of the drag stay (Clearance A). The clearance should be 0.003 in. to 0.008 in. Adjust the thickness of the shims under the head of the stop bolts to achieve this clearance.

(6) Select the gear up. Using the hand pump, slowly retract the nose gear until the drag stay has started to fold. This will position the roller over the radial upper face of the cam on the lower arm (Clearance B). The clearance should be 0.005 in. to 0.012 in. Adjust the length of the short link to obtain this clearance. After adjustment make sure that the short link ends are in safety and wirelocked.

(7) Select the gear down and pump the nose gear to the locked down position. Insert the nose leg ground locking pin.

(8) Release the residual hydraulic pressure (Chapter 29, MAIN SYSTEM).

**F. Close up**

(1) Lower the airplane to the ground (Chapter 7, JACKING AND TRESTLING).

(2) Make sure the work area is clean and clear of tools and miscellaneous equipment.

## NOSE GEAR DOORS - MAINTENANCE PRACTICES

### 1. Unit servicing

#### A. Lubrication

For routine lubrication data, refer to the Maintenance Schedule.

### 2. Removal/Installation

#### A. Remove door

(1) Disconnect door operating strut at centre hinge.

(2) Note position of shims at hinge positions.

(3) Remove all three hinge bolts and washers, and remove door.

#### B. Install door (Fig.201)

(1) Jack aircraft (See Chapter 7 - LIFTING AND SHORING)

(2) Attach each door to the fuselage at the three hinge positions and adjust washers at the centre hinge to give the correct clearance between the door and the fuselage outer skin, at front and rear.

(3) With the nose gear retracted, lift the doors to the closed position and check :-

(a) The side clearance between the doors and between the doors and the fuselage skin. Adjust the serrated plates at the hinge fittings, as necessary, to obtain correct clearances.

(b) That the doors are flush with the fuselage skin, within the maximum tolerances of 0.10 in. out of wind and 0.03 in. into wind. Adjust, as necessary, the shims under each hinge fitting.

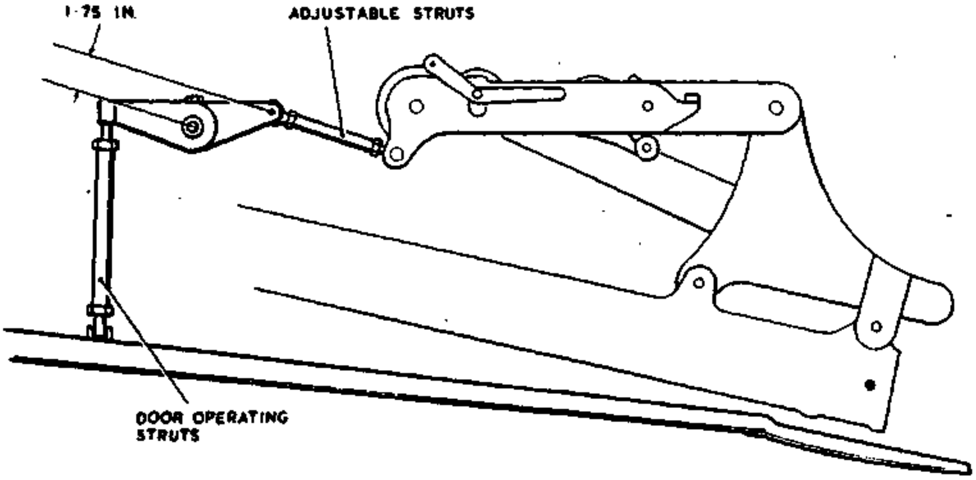
(4) With the door operating struts still disconnected at the centre hinge and the nose gear locked up, check the offset between the centre-line of the adjustable struts connected to the drag stay upper arms and a parallel line through the centre of the torque shaft. Adjust on the struts as necessary.

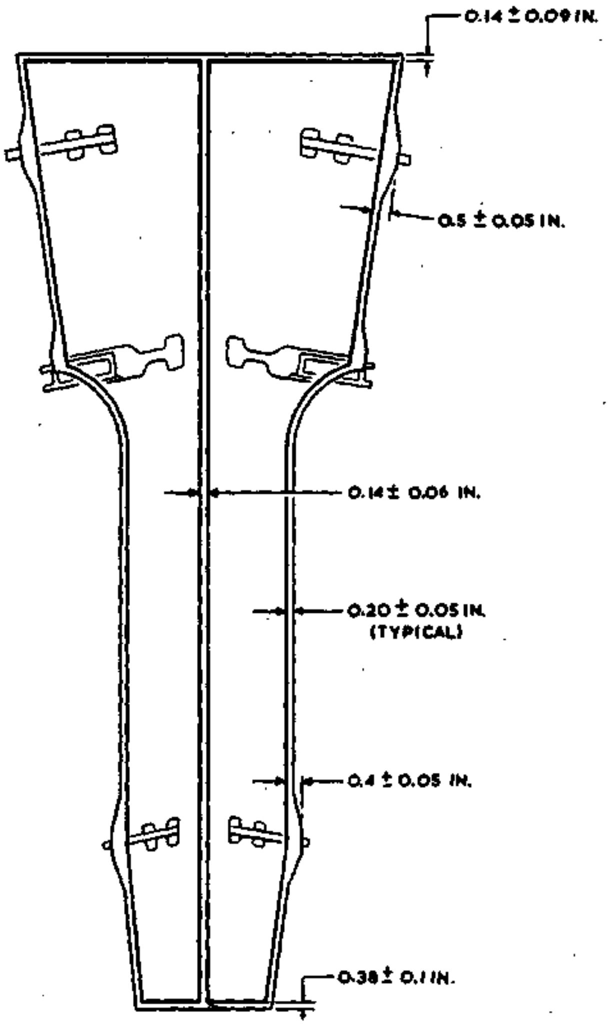
(5) Connect the operating struts to the door centre hinges and adjust the lengths of the struts so that with the nose gear locked up, the outer skin of the doors is flush with the adjacent outer fuselage skin and the clearances obtained in operation (3) are maintained. Lower the gear and shorten the operating struts by half a complete turn of each strut body. Disconnect each operating strut in turn; raise and lower the landing gear, and check that there is at least 0.05 in. clearance between the operating strut and structure or hydraulic pipes. Secure operating struts to doors.

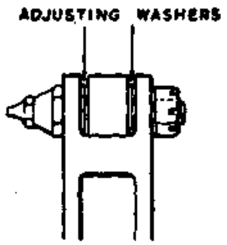
(6) Effect locking at door hinges, check ends of adjustable struts are in safety and wire-lock.

(7) Raise and lower the landing gear (see Chapter 29, MAIN SYSTEM), check for correct door operation.

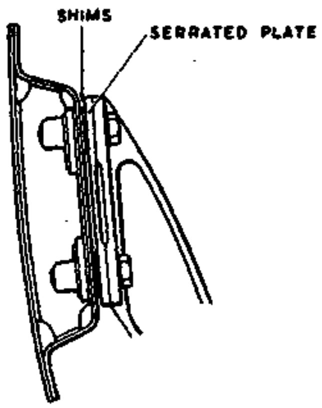
(8) Lower aircraft (See Chapter 7 - LIFTING AND SHORING)







CENTRE HINGE CONNECTION



TYPICAL ADJUSTMENT FEATURES AT DOOR HINGE

4471/1

Nose gear door adjustment
Fig.201

* * *

# EXTENSION AND RETRACTION - DESCRIPTION AND OPERATION

## 1. Description (Fig.1 and 2)

The landing gear is extended and retracted by the operation of a hydraulic jack at each of the main and nose gear units. Hydraulic power is normally provided by the main hydraulic system, but for emergency lowering, an auxiliary system supplies fluid, via shuttle valves, to the down side of the leg jacks. Restrictors in the up lines control the rate of extension and (Mod.252837) are protected by in-line filters.

During main hydraulic system operation, auxiliary system pipes are vented to return through an on/off valve. A dump valve directs main system fluid to return during auxiliary system operation; refer to Chapter 29.

The hydraulically operated doors covering the wheels operate a sequence valve through a linkage when the doors are opened. The sequence valve is effective only on gear up selection. Sidestay movement is transmitted through a linkage to operate a reversing valve when the main gear legs lock up or down, thus allowing a hydraulic pressure supply to one side or the other of the door jacks.

When the gear is up, roller locks on the wheel doors engage in structure-mounted brackets and operate indicator lamp microswitches.

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## 2. Operation of main gear wheel door

### A. Retraction

With the landing gear locked down the wheel doors are closed but not locked. When the landing gear is selected up hydraulic power is supplied to extend the door jacks which in turn operate the sequence valves to allow pressure to the main gear jacks. On the gear locking up reversing valves are operated causing the door jacks to be retracted. In this final movement, the door is locked up.

### B. Extension

When the landing gear is selected down, fluid is fed to both door jack and main gear jack, and extension is simultaneous. As the gear locks down, the reversing valve is actuated causing the door jack to retract into an unlocked up position.

In case of emergency lowering of gear, the wheel doors are pushed open by the descending main gear.

## 3. Controls (Fig.3)

A selector lever, mounted on the pressure bulkhead, protrudes through a gated slot in the pilots' centre instrument panel. The lever is connected, by rods, levers and a shaft, to a selector valve in the roof of the nose gear bay. A locking solenoid in the selector lever assembly, operating in

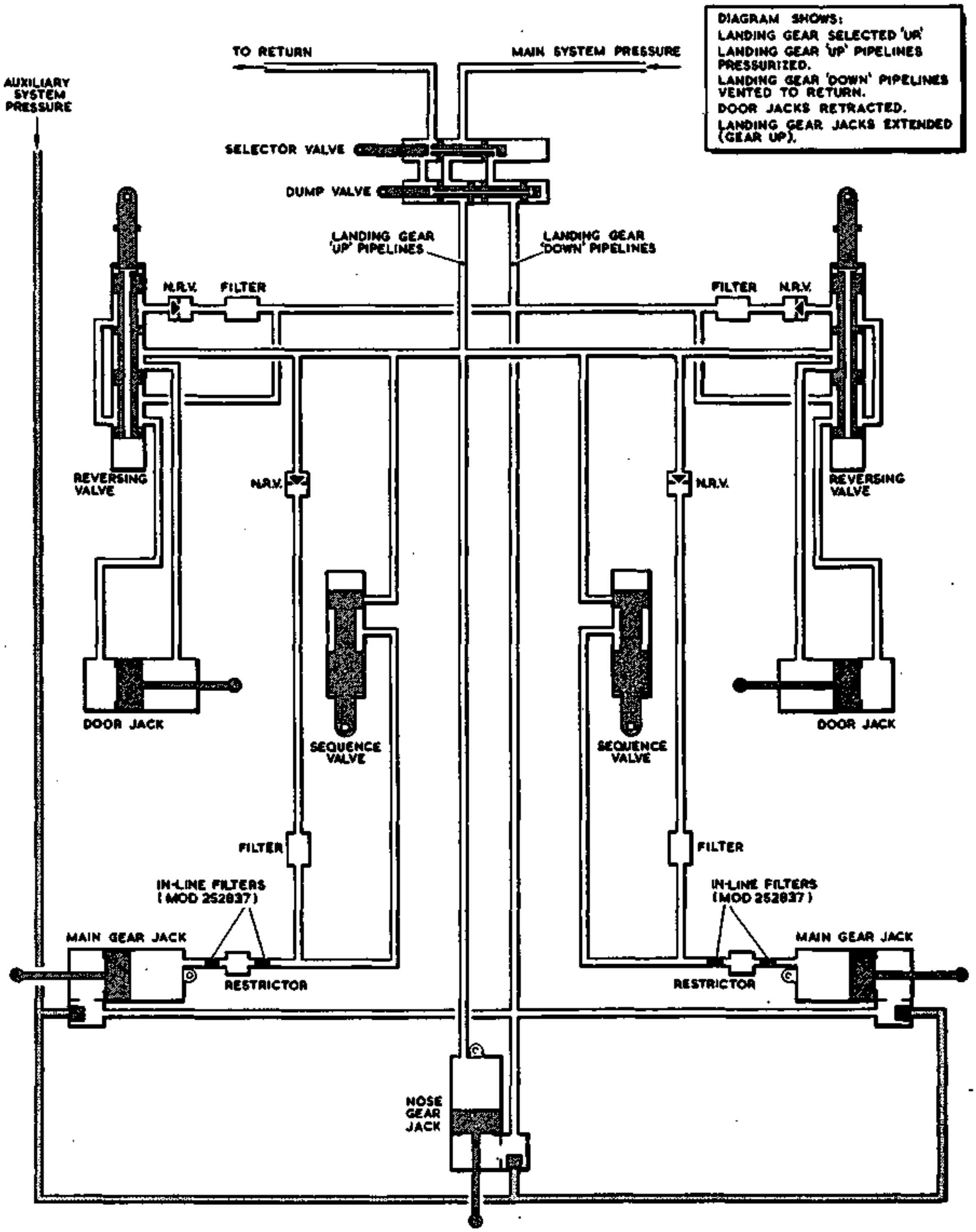
DIAGRAM SHOWS:
LANDING GEAR SELECTED 'UP'
LANDING GEAR 'UP' PIPELINES PRESSURIZED.
LANDING GEAR 'DOWN' PIPELINES VENTED TO RETURN.
DOOR JACKS RETRACTED.
LANDING GEAR JACKS EXTENDED (GEAR UP).
TO RETURN
MAIN SYSTEM PRESSURE
AUXILIARY SYSTEM PRESSURE
SELECTOR VALVE
DUMP VALVE
LANDING GEAR 'UP' PIPELINES
LANDING GEAR 'DOWN' PIPELINES
N.R.V.
FILTER
FILTER
N.R.V.
REVERSING VALVE
REVERSING VALVE
N.R.V.
N.R.V.
DOOR JACK
DOOR JACK
SEQUENCE VALVE
SEQUENCE VALVE
FILTER
FILTER
IN-LINE FILTERS (MOD 252837)
IN-LINE FILTERS (MOD 252837)
MAIN GEAR JACK
MAIN GEAR JACK
RESTRICTOR
RESTRICTOR
NOSE GEAR JACK
5509/1

Landing gear hydraulics
Fig.1

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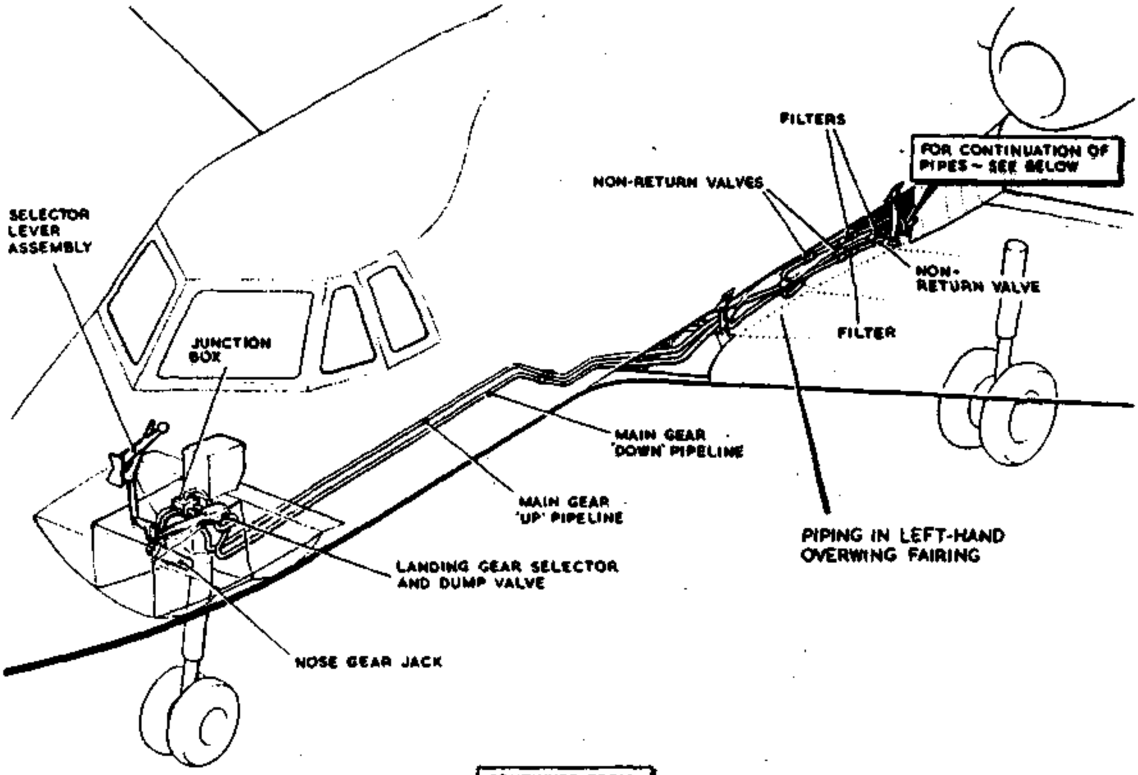
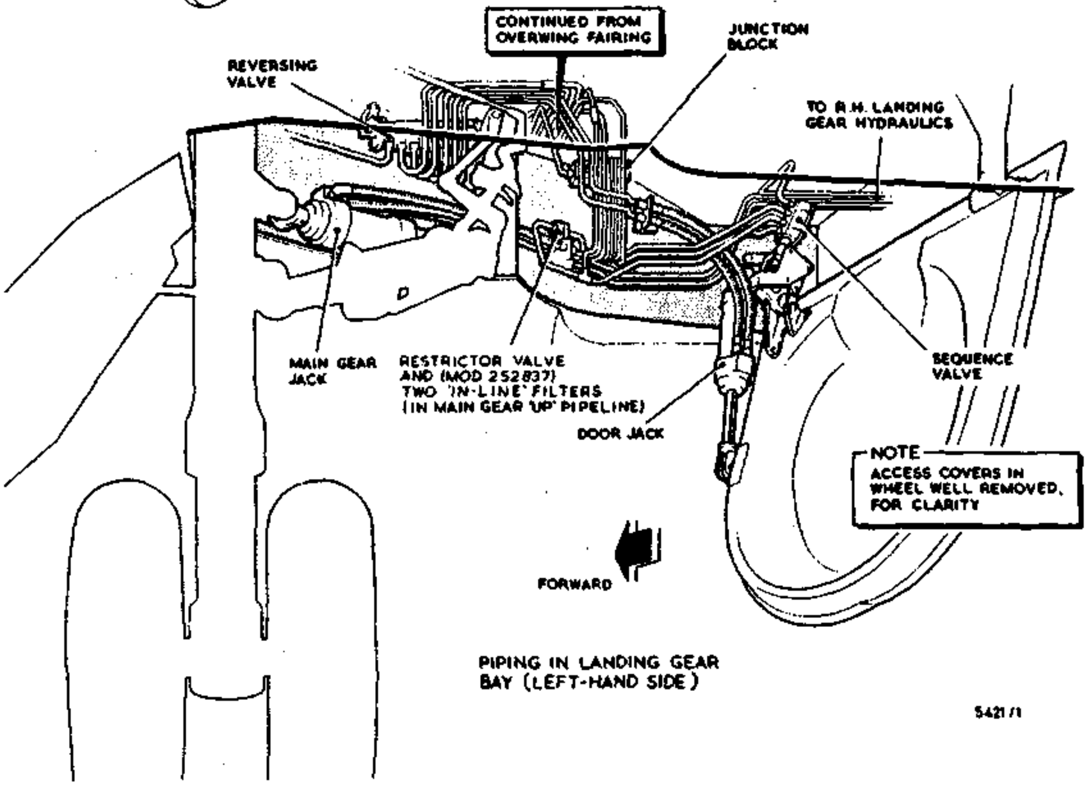


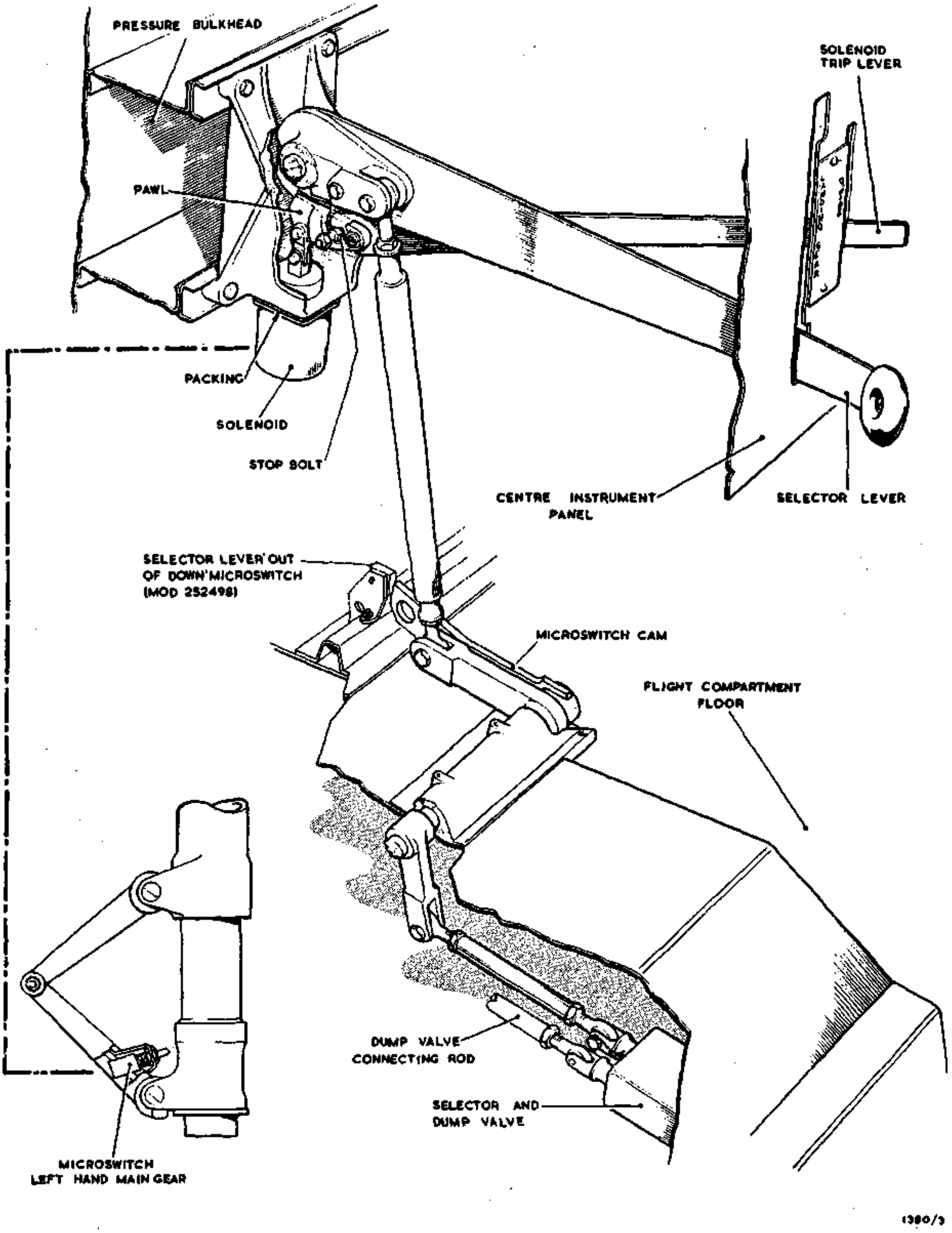
PIPING IN LEFT-HAND OVERWING FAIRING


CONTINUED FROM OVERWING FAIRING
JUNCTION BLOCK
REVERSING VALVE
TO R.H. LANDING GEAR HYDRAULICS
MAIN GEAR JACK
RESTRICTOR VALVE AND (MOD 252837) TWO 'IN-LINE' FILTERS (IN MAIN GEAR 'UP' PIPELINE)
DOOR JACK
SEQUENCE VALVE
FORWARD
5421/1

NOTE
ACCESS COVERS IN WHEEL WELL REMOVED, FOR CLARITY

PIPING IN LANDING GEAR BAY (LEFT-HAND SIDE)

Location of landing gear hydraulics
Fig.2



Landing gear selector controls
Fig.3

conjunction with a microswitch on the left-hand main gear, prevents an up selection being made with the weight of the aircraft on the landing gear. A trip lever, adjacent to the selector lever, enables the locking solenoid to be released in an emergency.

## 4. Lever lock

The selector lever is formed with a cam segment which engages with a pawl when the lever lock is applied, the pawl being connected to a solenoid attached to the selector lever mounting. On the torque link of the left-hand main gear is a microswitch which is in circuit with the lever lock solenoid. The electrical supplies are taken from busbar PS1.

With the main gear leg extended (aircraft in flight or on jacks), the leg microswitch is closed and the locking solenoid energized to withdraw the pawl clear of the cam segment. The selector lever is now free to move between landing gear up and down selections.

When the main gear leg is compressed (aircraft on ground) the leg microswitch is opened, breaking the power supply to the locking solenoid. If an up selection is now attempted, the end face of the selector lever cam segment contacts the pawl and further selector lever movement is prevented.

Lifting the trip lever breaks the lock mechanically; the end of the trip lever contacts a stop bolt on the pawl and the pawl is then moved clear of the selector lever cam segment against the action of the solenoid spring.

Mod.252498: An 'out-of-down position' warning microswitch automatically lights the red landing gear position indicators when the selector lever is not in the gated down position.

* * *

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## EXTENSION AND RETRACTION - MAINTENANCE PRACTICES

### 1. Inspection/Check

A. Inspect main gear up line filters (Mod.252837)

(1) Fit ground locks to all landing gear units (see Chapter 10, PARKING AND MOORING).

(2) Release hydraulic pressure (see Chapter 29, MAIN SYSTEM).

(3) Gain access to main gear bay and lower wheelwell door.

(4) Remove the necessary panels from wheelwell forward wall to gain access to the hydraulic system areas shown on Fig.201 A and B.

(5) Slacken or release pipeline clamps as necessary and disconnect the cone junctions containing the in-line filter elements shown.

(6) Carefully separate each of the pipe joints in turn and remove and inspect the filter elements.

(7) CAUTION : ON FILTER REPLACEMENT ENSURE THAT CORRECT SIZE FILTER APPROPRIATE TO PIPELINE DIAMETER IS INSTALLED - SMALL FILTER IN 1/4 IN. O/D PIPELINE, LARGE FILTER IN 5/16 IN. O/D PIPELINE.

Replace with new in-line filters or clean existing filters using Trichloroethane or equivalent (see Chapter 20, CLEANING AGENTS).

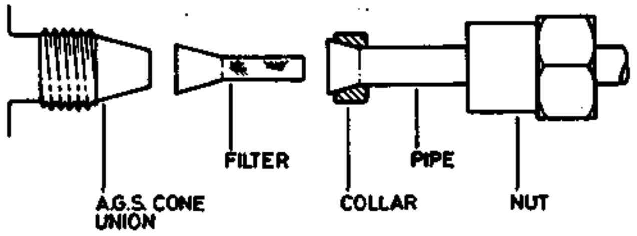
(8) Reconnect cone junctions and secure pipeline clamps as necessary.

(9) Function test landing gear (see Chapter 29, MAIN SYSTEM).

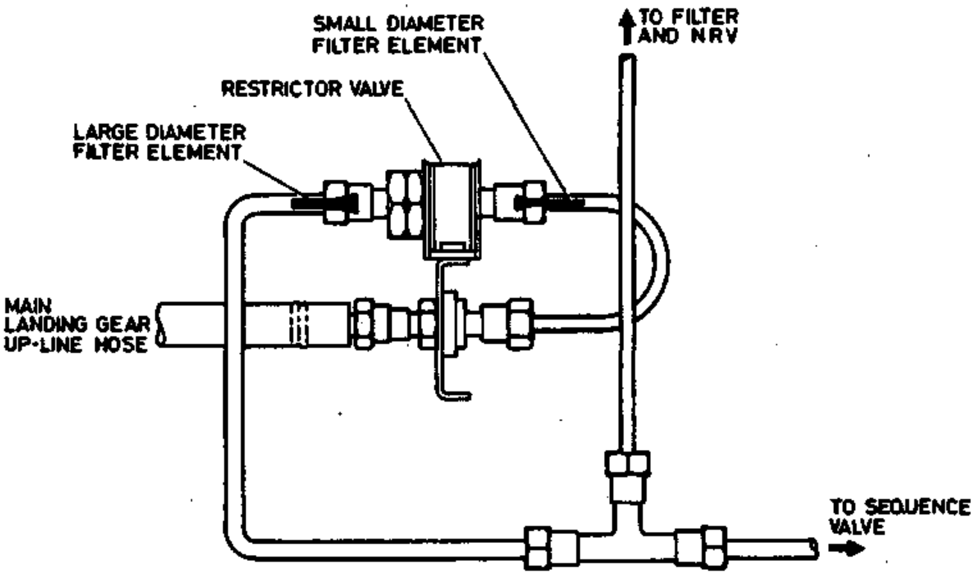
(10) Inspect particularly both main landing gear up lines for leakage at disturbed pipe unions and refit access panels.

Fig.201 overleaf

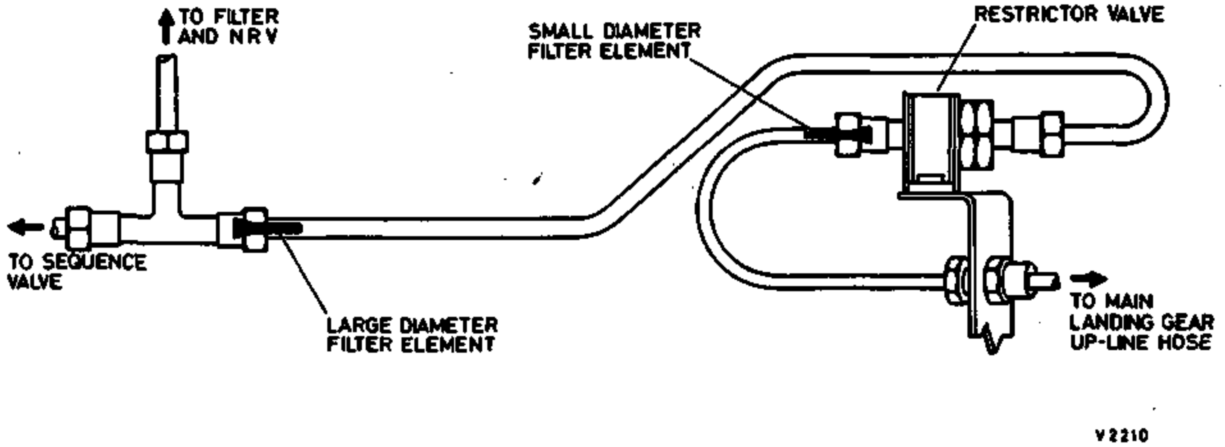
...Extension and retraction - Maintenance practices continued



TYPICAL IN-LINE FILTER ELEMENT IN A.G.S. CONE JUNCTION


SMALL DIAMETER FILTER ELEMENT
TO FILTER AND NRV
RESTRICTOR VALVE
LARGE DIAMETER FILTER ELEMENT
MAIN LANDING GEAR UP-LINE HOSE
TO SEQUENCE VALVE

**A** LOCATION OF IN LINE FILTER ELEMENTS IN L.H. MAIN LANDING GEAR BAY


TO FILTER AND NRV
SMALL DIAMETER FILTER ELEMENT
RESTRICTOR VALVE
TO SEQUENCE VALVE
LARGE DIAMETER FILTER ELEMENT
TO MAIN LANDING GEAR UP-LINE HOSE
V2210

**B** LOCATION OF IN-LINE FILTER ELEMENTS IN R.H. MAIN LANDING GEAR BAY

In-line filter locations
Fig.201

* * *

# NOSE GEAR RETRACTION JACK REMOVAL/INSTALLATION

## 1. Nose gear retraction jack

### A. Removal *(Figure 401)*

**CAUTION: MAKE SURE THE AREA IS CLEAN AND IS KEPT CLEAN. THIS IS TO PREVENT CONTAMINATION OF THE HYDRAULIC SYSTEM.**

*NOTE: Install blanks to all disconnected hydraulic components and pipe connectors.*

(1) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(2) Release the hydraulic system pressure (Chapter 29, MAIN SYSTEM).

(3) Remove the wirelocking and disconnect the hydraulic connections to the retraction jack.

(4) Remove the split pin, nut and washer from the retraction jack at the leg pick up forging.

(5) Remove the split pin, nut and washer from the retraction jack at the leg bridge casting and remove retraction jack.

### B. Installation *(Figure 401)*

| Equipment/Material | Part/Item No. |
|---|---|
| Grease | 078 (Chapter 20-95-11) |
| De-greasing agent | 230 (Chapter 20-95-201) |
| Wire, corrosion resistant | 651 (Chapter 20-95-601) |
| Suitable container for spillage | Local supply |
| Male and female blanking caps to suit | Local supply |

*NOTE: Remove blanks from hydraulic components and pipe connectors.*

*NOTE: For routine lubrication data refer to the Maintenance Schedule.*

(1) Lubricate the leg pick-up forging and bridge casting axis pins with grease (Item 078).

(2) Connect the retraction jack to the leg pick-up forging and the bridge casting axis pins using washers, nuts and new split pins.

(3) Connect the hydraulic connections to the retraction jack and wirelock.

(4) Pressurize the hydraulic system (Chapter 29, MAIN SYSTEM).

(5) Do a function test of the landing gear (Chapter 29, MAIN SYSTEM).

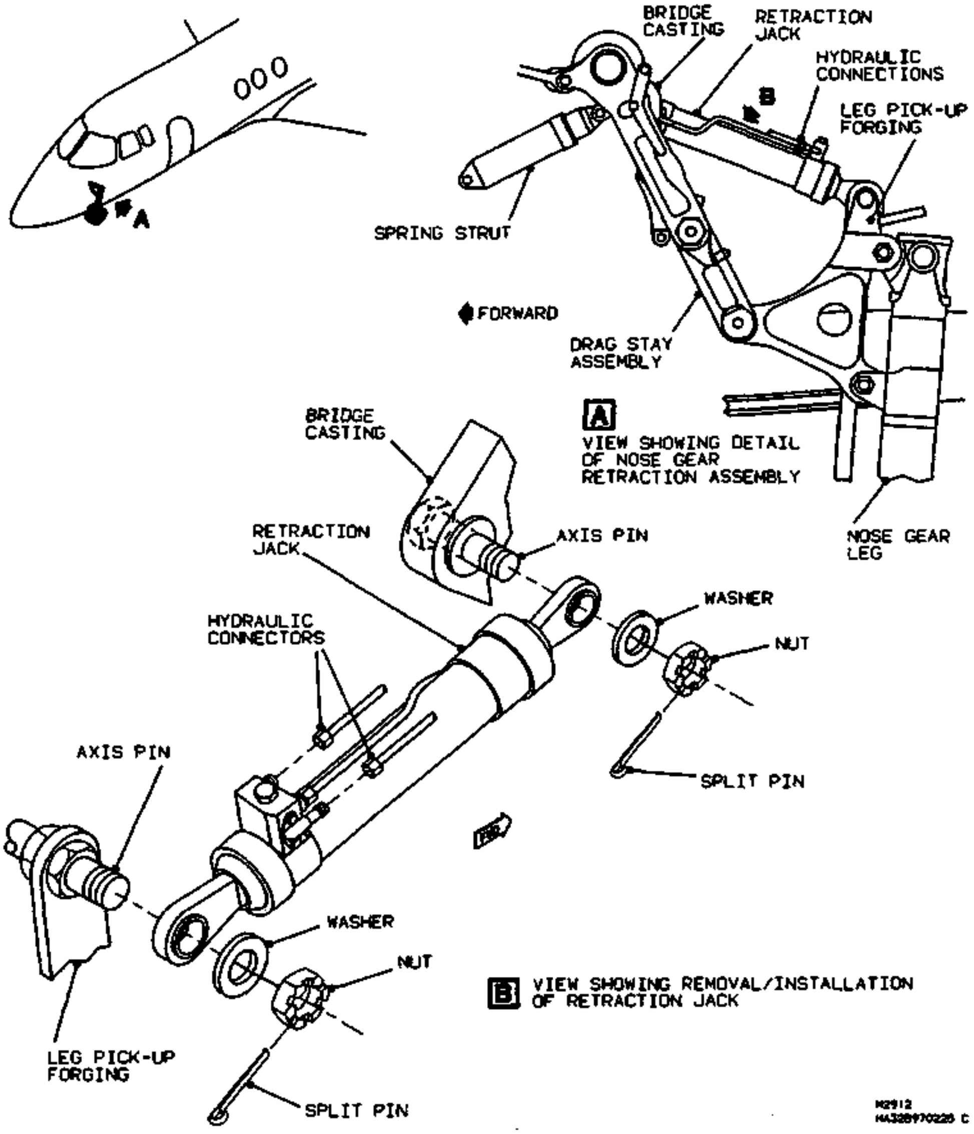
(6) Examine the retraction jack for hydraulic fluid leaks.

(7) Make sure all disturbed connections are locked.

**C. Close up**

(1) Lower the airplane (Chapter 7, JACKING AND TRESTLING).

(2) Make sure the work area is clean and clear of tools and miscellaneous equipment.



Nose gear retraction jack - Removal and installation.

*Figure 401*

# LANDING GEAR SELECTOR CONTROLS - ADJUSTMENT/TEST

## 1. Procedure

### A. Adjust selector controls *(Figure 501)*

(1) Install ground locks to all landing gear units (Chapter 10, PARKING AND MOORING).

(2) Release hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Set selector valve to down selection (valve fully in).

(4) Disconnect adjuster rod from bellcrank.

(5) Make sure selector lever is gated DOWN (at bottom of the slot in pilots' instrument panel). Maintain at this setting.

(6) Adjust selector lever adjuster rod to set bellcrank at dimension 'X' when connected to bellcrank.

(7) Check adjusted rod end is in safety, tighten and wire-lock.

*NOTE: Make sure that the bolt at the top of the selector lever adjuster rod is installed correctly. The head of the bolt should be facing inboard (towards the left hand side of the airplane).*

(8) Do a functional test of the lever lock, (refer to paragraph1.C.).

(9) Do a functional test of the landing gear (Chapter 29, MAIN SYSTEM).

### B. Adjust lever lock microswitch

(1) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING).

(2) Energize relevant busbar (Chapter 24, GENERAL).

(3) Loosen the nuts securing the microswitch body, and back off the microswitch.

(4) Adjust the body position until the lever lock solenoid in the pedestal operates. From this position, move the body further toward the leg by rotating the backing nut 2 to 3 turns.

(5) Screw back the locknut and lock tab washer on backing nut. Wire-lock nuts together.

(6) Lower airplane from jacks and check that the microswitch plunger is released and clear of the leg when the oleo is compressed.

(7) De-energize busbar.

### C. Test lever lock and trip lever

(1) Install ground locks to all landing gear units (Chapter 10, PARKING AND MOORING).

(2) Release hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Energize relevant busbar (refer to paragraph 1.B.(2)).

(4) Make sure that lock mechanism functions by attempting to select landing gear UP.

(5) Lift trip lever and check that there is now full and free movement of the selector lever to UP.

*NOTE: Make sure that the bolt at the top of the selector lever adjuster rod is installed correctly. The head of the bolt should be facing inboard (towards the left hand side of the airplane).*

(6) Return selector lever to DOWN position.

**CAUTION: RETURN SELECTOR LEVER TO DOWN POSITION.**

(7) Depress lever lock microswitch on leg and check that there is now full and free movement of the selector lever to UP.

(8) De-energize busbar.

**D. Adjust lever 'out of down' position microswitch (Mod.252498)**

(1) Install ground locks to all landing gear units (Chapter 10, PARKING AND MOORING).

(2) Release all hydraulic pressure (Chapter 29, MAIN SYSTEM).

(3) Energize relevant busbar (Chapter 24, GENERAL).

(4) Check that microswitch roller is central to its operating cam.

(5) Position undercarriage selector lever approximately 0.95 in. from fully DOWN position and set cam so that microswitch roller is on crest of cam.

(6) Rotate microswitch in its bracket so that a 0.012 in. feeler gauge can just be inserted between roller and cam when switch has bottomed. Make sure that lockwasher is assembled between bracket and nut and check tighten switch securing nuts.

(7) Slightly loosen lever fulcrum nut at cam serrations and raise cam until switch is just tripped as indicated by red landing gear lights.

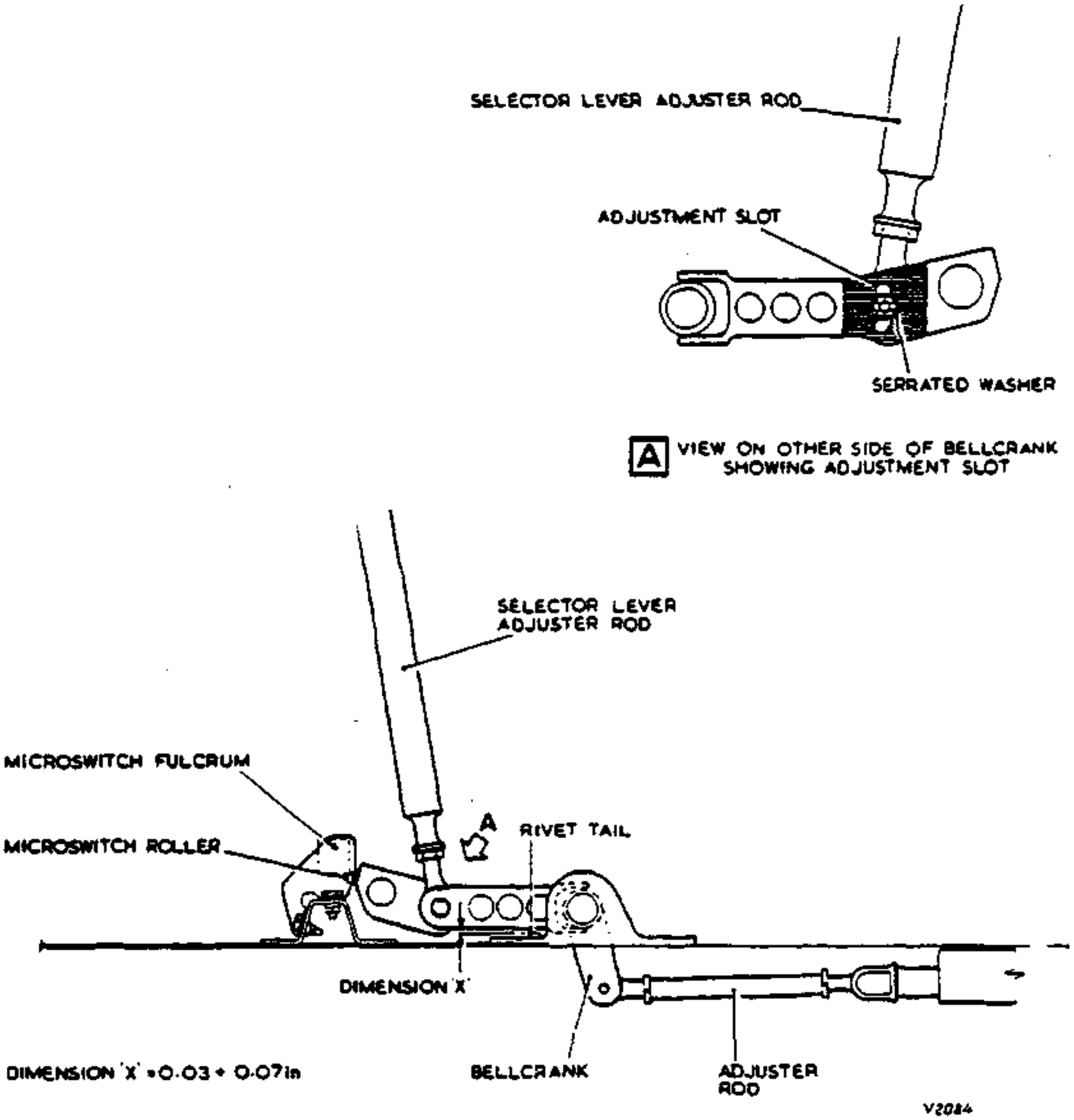
*NOTE: If necessary, to permit engagement of nearest serrations of cam with those in washer, the cam may be further raised and the nut fully tightened and locked.*

*NOTE: On completion of this operation, all landing gear position indicators or annunciators are on (reds and greens). When lever is moved at the following operation the reds will go off.*

(8) With selector lever in the fully DOWN position, check that roller is on crest of cam and that 0.012 in. feeler gauge can just be inserted between roller and cam.

(9) Check that when lever is moved from UP to DOWN microswitch is tripped 'on' at greater than 0.30 in. from fully DOWN position, and when moved from DOWN to UP microswitch is tripped 'off' at less than 1.10 in. from fully DOWN position.

(10) Raise the airplane on jacks (Chapter 7, LIFTING AND SHORING). Remove ground locking pin and pressurize hydraulic system


SELECTOR LEVER ADJUSTER ROD
ADJUSTMENT SLOT
SERRATED WASHER
A VIEW ON OTHER SIDE OF BELLCRANK SHOWING ADJUSTMENT SLOT
SELECTOR LEVER ADJUSTER ROD
MICROSWITCH FULCRUM
MICROSWITCH ROLLER
A
RIVET TAIL
DIMENSION 'X'
DIMENSION 'X' =0.03 + 0.07in
BELLCRANK
ADJUSTER ROD
V2084

Selector control setting and microswitch adjustment

*Figure 501*

(11) Operate undercarriage selector lever and check that when selector is moved less than 1.35 in. from locked DOWN position the landing gear does not retract.

(12) Return selector lever to DOWN position.

(13) Install ground locking pins.

(14) De-energize relevant busbar.

## SOLENOID - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove solenoid

(1) Isolate solenoid electrical circuit (see Chapter 24, GENERAL).

(2) Gain access to the rear of the centre instrument panel (see Chapter 31, INSTRUMENT PANELS).

(3) Disconnect solenoid electrical connections.

(4) Remove pin at solenoid link, remove bolts securing solenoid to mounting and remove solenoid; retain adjusting shim.

#### B. Install solenoid

(1) Position adjusting shim on solenoid body and temporarily secure solenoid to mounting with bolts. Attach solenoid to link with pin.

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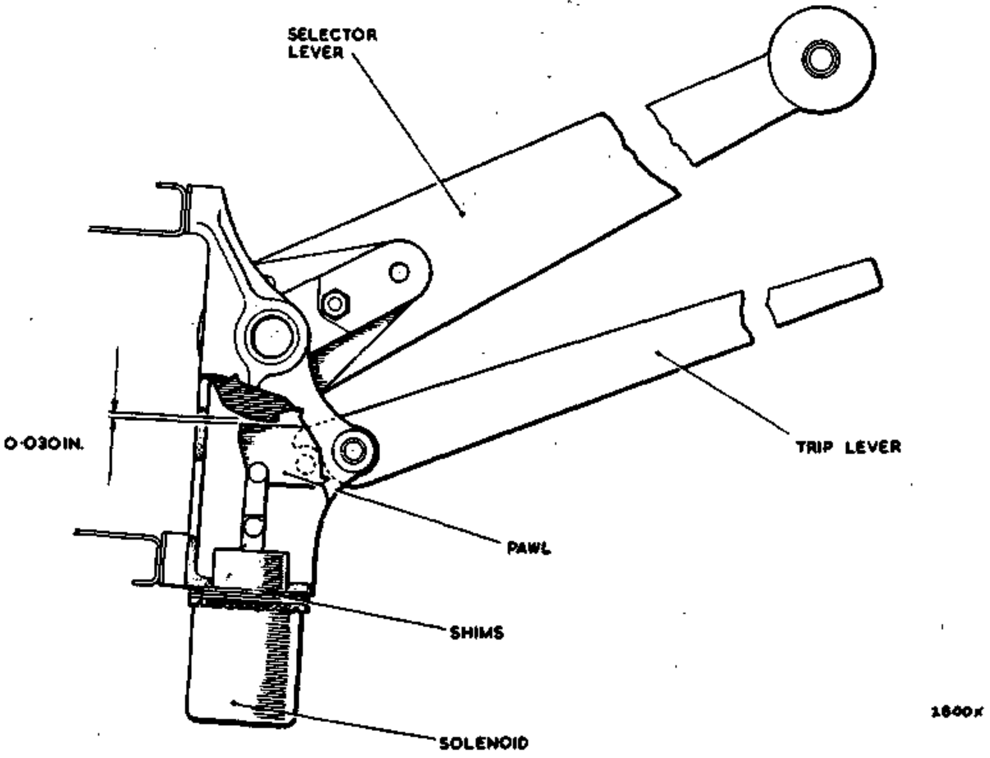

Lever lock solenoid adjustment
Fig.201

...Solenoid - Maintenance practices continued

(2) Make electrical connections and restore solenoid electrical supplies (see Chapter 24, GENERAL).

(3) Fit ground locks to all landing gear units (see Chapter 10, PARKING & MOORING).

(4) Release hydraulic pressure (see Chapter 29, MAIN SYSTEM).

(5) Energize relevant busbar (see Chapter 24, GENERAL).

(6) Depress the lever lock microswitch on the left main leg and slowly select landing gear up.

(7) Check that when the lobe of the cam segment on the selector lever is above the pawl the clearance is as shown on Fig.201. Remove or add shims as necessary to obtain correct clearance. Select landing gear down.

(8) Lock link pin with split pin. Tighten solenoid securing bolts and wire-lock heads in pairs.

(9) Refit centre instrument panel (see Chapter 31, INSTRUMENT PANELS).

(10) Test lever lock and trip lever operation (see Chapter 29, LANDING GEAR SELECTOR CONTROLS).

* * *

# MAIN GEAR JACKS - MAINTENANCE PRACTICES

## 1. Unit servicing

For routine lubrication data refer to Maintenance Schedule.

## 2. Removal/Installation

Equipment and materials required :-

| | |
|---|---|
| Door jack clamp .. .. | BAe 25Y1491A |
| Grease .. .. | DTD 844, 866 or 5598 |
| Locking compound, Loctite Grade 270 | DTD 900/6003 |

### A. Remove main gear jack

(1) Jack the aircraft (see Chapter 7, LIFTING AND SHORING).

(2) With the landing gear locked 'down' fit ground lock pins.

(3) Release hydraulic system pressure (see Chapter 29, MAIN SYSTEM).

(4) Open both main wheel well doors manually to their fullest extent. Fit door jack clamps.

WARNING : IT IS RECOMMENDED THAT THE SPECIAL CLAMPS ARE FITTED TO PREVENT DOOR MOVEMENT DURING SUBSEQUENT RETRACTIONS AND EXTENSIONS OF THE MAIN LANDING GEAR.

(5) Disconnect fairing strut from attachment on leg (see Chapter 32, MAIN GEAR FAIRINGS). Move fairing away from leg and suitably support and protect it to prevent foul during landing gear movement.

(6) Position receptacle to catch residual fluid.

(7) Remove flexible hose connections from jack adapters. Blank off hose connections and jack adapters.

(8) Remove pin and disconnect jack ram eye end from leg retraction lever.

(9) Remove bolt and disconnect jack body fork-end from side stay pivot fitting. If Mod.252091 (eccentric bush in pivot fitting) is embodied, note position of eccentric bush in relation to engraved arrow head on pivot fitting (see Fig.201).

### B. Install main gear jack

NOTE : Ensure handed jack is correct for LH or RH leg (see Chapter 32, CONTENTS).

(1) Fully retract jack ram.

(2) Mod.252091 : Check that on the left-hand side stay, the pivot fitting is located with its engraved arrow head and flange of eccentric bush on the upper side of the pivot fitting, and/or, on the right-hand side stay the pivot fitting is located with the arrow head and flange of eccentric

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bush on the lower side of the pivot fitting. If a new jack is being installed, rotate the eccentric bush to position 4. If the original jack is being installed, ensure it is located at the position noted in operation 2.A.(9).

NOTE : The eccentric bush provides adjustment to minimize jack ram over-travel. The flat of the bush having one identification groove (position 1) coincides with minimum wall thickness, the flat with four grooves (position 4) coincides with maximum wall thickness. With Mod 252267 embodied the bush is retained with locking compound.

(3) Position jack body fork-end on side stay pivot fitting. Fit bolt (head on lower side of pivot fitting), washer and nut; tighten nut and lock with split pin.

(4) Remove blanks from hose connections and jack adapters. Fit hoses to jack adapters.

(5) Mod 252091: If the original jack is being installed, proceed with operation 2.B.(6). If a new jack is being installed, proceed as follows :-

(a) Position jack so that ram extension will not foul components or structure during the following operation.

(b) Using the aircraft ground servicing handpump, select landing gear 'up' and operate handpump slowly to extend the jack ram. When jack ram reaches the limit of its travel, stop pumping. Measure, and record, the length of the jack ram extension from the jack body.

(c) Select landing gear 'down' and operate handpump to retract jack ram. When jack ram reaches the limit of its travel, stop pumping.

(d) Fit jack ram eye end (grease nipple on upper side) to leg retraction lever. Fit pin (head forward), washer and nut; tighten nut and lock with split pin.

NOTE : If it is necessary to rotate jack ram eye end to locate grease nipple, it must be in a clockwise direction relative to jack body.

(e) Ensure ground lock pin is fitted to nose leg, and to the opposite main gear leg. If both main gear jacks are being checked only the nose ground lock pin need be fitted.

(f) Select landing gear 'up', and operate aircraft ground servicing handpump to retract landing gear. When landing gear is locked 'up', stop pumping and release hydraulic pressure. Measure, and record, the length of the jack ram extension from the jack body.

...Main gear jacks - Maintenance practices continued

(g) Where the difference between measurements obtained in operations (b) and (f) is 0.13 in. or less, leave eccentric bush (operation 2.B.(2)) at position 4. If the difference is greater than 0.13 in., remove the jack body from the side stay pivot fitting and rotate the pivot fitting eccentric bush as follows :-

over 0.13 in. and up to 0.16 in., rotate bush to position 3.
over 0.16 in. and up to 0.23 in., rotate bush to position 2.
over 0.23 in., rotate bush to position 1.

(h) Mod 252267: Note position of eccentric bush and remove from pivot. Assemble bush to pivot using locking compound in accordance with HSA Spec. S26-4507 (see Chapter 20). Finally set bush to position established in operation (g).

(j) Fit jack body fork-end fittings on side stay pivot fitting. Fit bolt (head on lower side of pivot fitting), washer and nut; tighten nut and lock with split pin.

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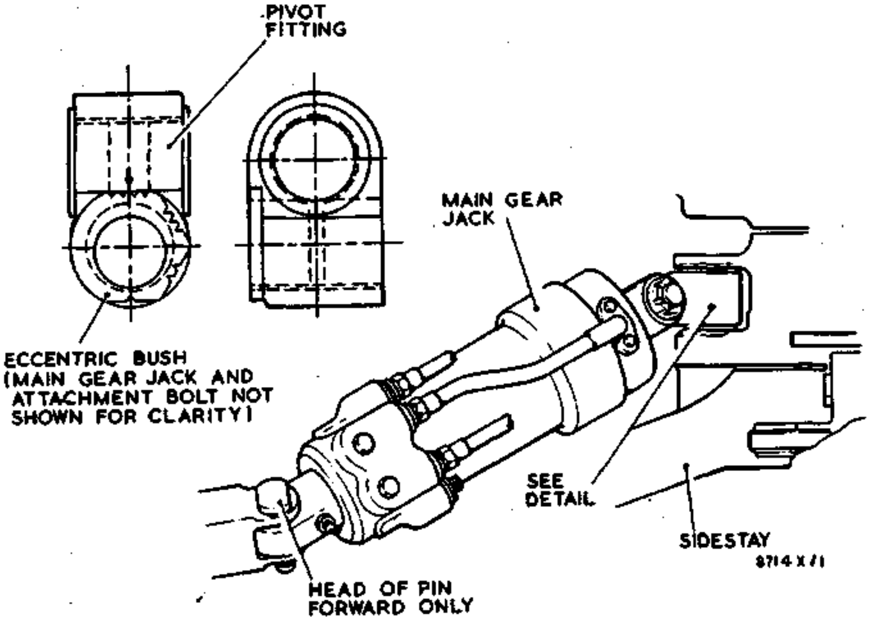

Jack to side stay pivot fitting - Mod 252091
Fig.201

...Main gear jacks - Maintenance practices continued

(6) Fit jack ram eye end (grease nipple on upper side) to leg retraction lever. Fit pin (see Fig.201), washer and nut; tighten nut and lock with split pin. Charge relevant grease nipples with grease.

NOTE : If it is necessary to rotate jack ram eye end to position grease nipple correctly, it must be in a clockwise direction relative to jack body.

(7) Remove ground lock pins.

(8) Functionally test the landing gear (see Chapter 29, MAIN SYSTEM). With landing gear locked up, visually check that there is clearance between newly installed jack and aileron control cable. Check main gear jack for signs of leakage.

(9) Fit and secure the fairings (see Chapter 32, MAIN GEAR FAIRINGS).

(10) Release hydraulic system pressure.

(11) Remove door jack clamps.

(12) WARNING : MAIN GEAR DOORS WILL CLOSE WHEN HYDRAULIC SYSTEM IS PRESSURIZED.

Pressurize hydraulic system to retract doors. Release pressure, if necessary.

(13) Fit ground lock pins.

(14) Lower aircraft.

* * *

# REVERSING VALVES - DESCRIPTION AND OPERATION

## 1. General

The Lockheed reversing valve AIR 48542 operates in conjunction with the main gear leg and ensures that the wheel well door is closed when the leg is locked up or down and that the door is open when the leg is unlocked and moving to the up or down position.

## 2. Description

Mounted on the aircraft structure, the valve is connected through a linkage and connecting rod to the main gear leg sequence mechanism.

The valve consists of a lapped plunger retained in a body by a bolted end cover at one end, and a gland housing at the other.

The body is bored and tapped to accommodate six adapters which connect the unit to the door and undercarriage jacks and to a drain. A longitudinal duct in the body permits transfer of fluid across the central waist of the plunger.

The plunger has three annular grooves between four lands and is longitudinally and radially bored to balance hydraulic loads across the plunger and to permit fluid seepage to pass to the drain. A fork-end, screwed on to the plunger, provides an attachment for the valve operating linkage.

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## 3. Operation

Plunger position is controlled by the leg sequence mechanism which transmits leg movement, via the connecting rod and valve linkage, to the valve plunger.

The valve operates through three positions in conjunction with four stages of leg movement as follows :-

i Main gear locked down - valve plunger fully IN.
ii Main gear locked up - valve plunger fully OUT.
iii Main gear in intermediate position (moving up or down) - valve in MID position.

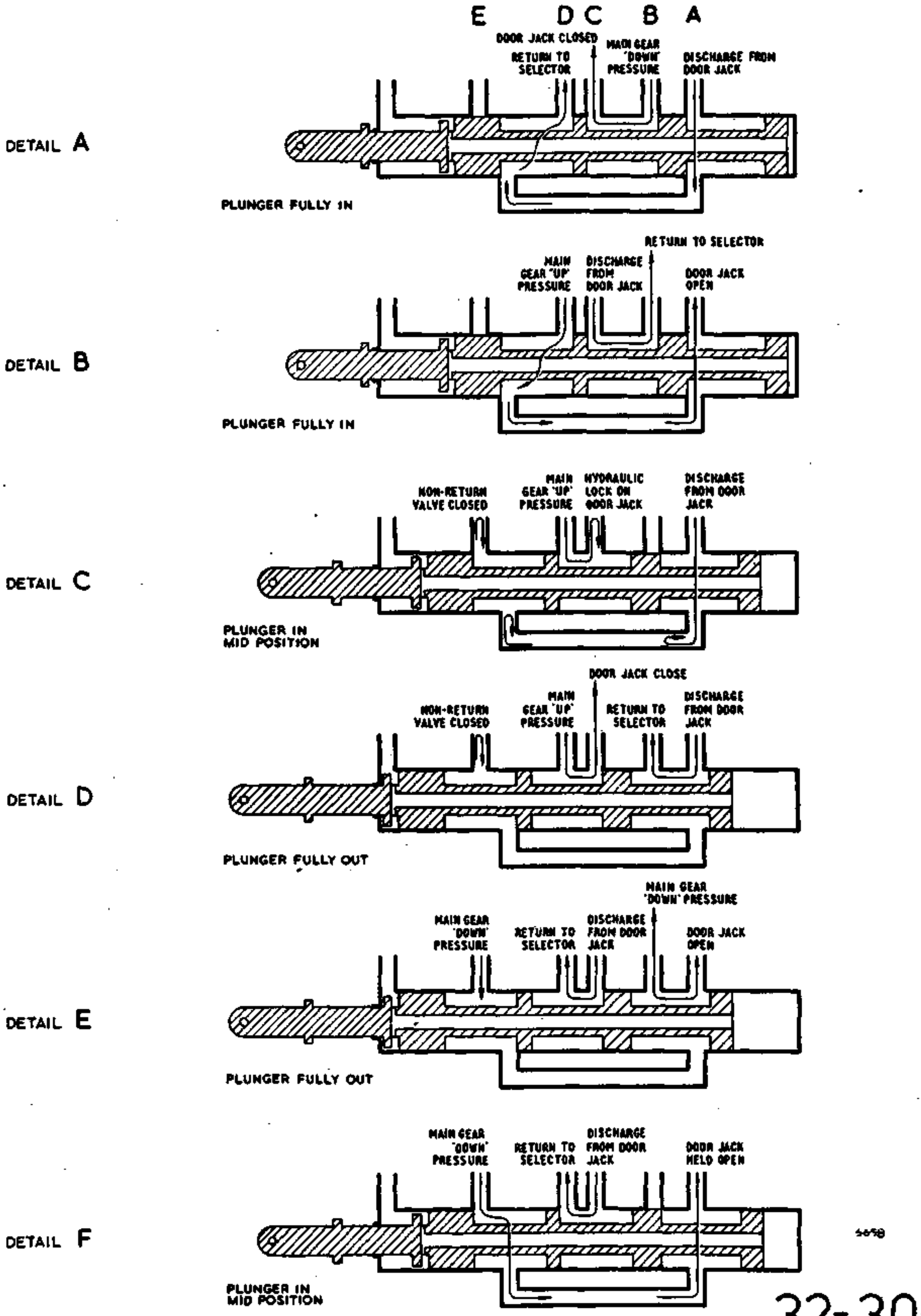
One of the two down pressure pipelines from the undercarriage selector valve incorporates a non-return valve (see Chapter 32, EXTENSION AND RETRACTION Fig.1).

### Fig. 1, Detail A

With the main gear down, plunger fully IN and a DOWN selection made at the landing gear selector, fluid at pressure passes from B to C causing the door jack to hold the door in the closed position. Fluid discharged from the door jack passes from A to D, through the longitudinal duct in the valve body, to the undercarriage up line which is connected to the return side of the undercarriage selector.

### Fig. 1, Detail B

With the main gear down and the plunger fully IN, an UP selection connects fluid pressure to D, through the longitudinal duct in the body to A. The door jack then



Reversing valve-schematic
Fig.1

extends and opens the door. Fluid discharged from the jack passes from C to B and then to return.

Although an UP selection has been made, the undercarriage will not retract until the wheel well door has fully opened. This is due to the independent sequence valve connected to the door, which allows fluid pressure to pass to the undercarriage retraction jack only when the door has reached the open position.

Fig. 1, Detail C

When the wheel well door has opened, the main gear leg starts to retract, this causes the plunger to move to the MID position. Pressure fluid passes from D to C but the door cannot close since B is blanked by the plunger and the non-return valve in the down line is closed, imposing a hydraulic lock to keep the door open.

Fig. 1, Detail D

When the undercarriage has retracted and is fully locked, the reversing valve is mechanically moved to the OUT position. Fluid pressure at D is directed to C where it is able to retract the door jack, the hydraulic lock being removed, thus closing the door. Discharged fluid from the jack is now able to pass from A to B and then to return.

Fig. 1, Detail E

With the undercarriage locked up, valve plunger fully OUT and the door closed, a DOWN selection connects fluid pressure to B and connects D to the return side of the undercarriage selector. Fluid is directed from B to A and then to the door jack which extends to open the door. Fluid discharged from the door jack passes from C to D and then to the return side of the selector.

Fig. 1, Detail F

When the undercarriage lock is withdrawn and the leg starts to move, the reversal valve is mechanically moved to the MID position. Fluid pressure from the selector opens the independent non-return valve to enter at E. From E the fluid passes through the longitudinal duct in the valve body to A where it holds the door jack and door in the open position while the leg moves down.

When the leg locks down, the valve plunger is moved to the fully IN position, (see Fig. 1, Detail A), fluid is then directed from B to C and the door jack, which then retracts to close the door.

The valve is now ready to repeat the cycle.

* * *

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## REVERSING VALVES - MAINTENANCE PRACTICES

### 1.Removal/Installation

Special equipment

| | |
|---|---|
| Door jack clamp .. .. .. | BAe 25Y1491A |

#### A.Remove reversing valve

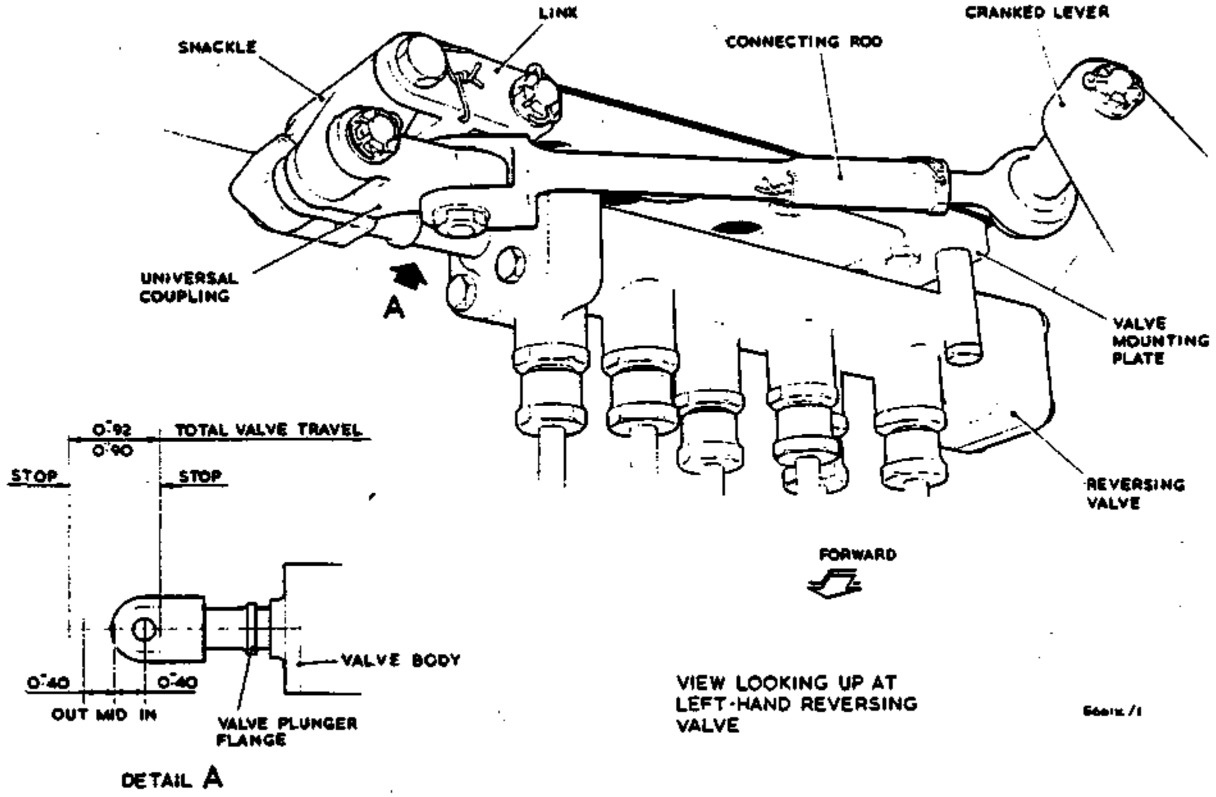
(1) Jack the aircraft (Chapter 7, LIFTING AND SHORING) and remove ground locking pin from relevant gear.

(2) With main gear locked down, depressurize the hydraulic system (see Chapter 29, MAIN SYSTEM).

(3) Open the wheel well door manually to its full extent. Fit door jack clamp on the door jack ram.

(4) Break wire-locking and remove bolt connecting the shackle to the link.

(5) Remove the bolt securing the connecting rod to the sequence mechanism cranked lever.



Reversing valve installation
Fig.201

...Reversing valves - Maintenance practices continued

(6) Place a suitable receptacle under the reversing valve and disconnect each hydraulic pipeline. Blank each pipe after disconnection.

(7) Unscrew and remove the two bolts securing the valve body to the valve mounting plate.

(8) Remove the valve and fit blanks to the open pipe adapters. Remove the valve linkage from the valve by removing the bolt which secures the connecting rod universal coupling and the valve fork-end to the shackle.

B. Checks/Tests before installation

(1) Check the valve body for cracks, damage and corrosion.

(2) Withdraw the valve plunger to its fullest extent and check that the distance between the plunger flange and the valve body is 0.90 in. to 0.92 in.

(3) Fit the valve linkage (Fig.201) and secure with bolt passing through valve fork-end, shackle and universal coupling. Fit retaining nut and lock.

C. Install reversing valve (Fig.201)

(1) Position the valve on its mounting plate and secure with bolts.

(2) Install the shackle in the link and secure with bolt. Wire-lock bolt.

(3) Remove blanks and connect valve pipelines to the valve adapters. Wire-lock union nuts.

(4) Fit, and adjust if necessary, the connecting rod to the cranked lever so that there is a nominal gap of 0.050 in. between the plunger flange and the valve body.

(5) Adjust side stay clearances and reversing valve mechanism (Ref.32-10-25 para.3.A.).

(6) Fix ground locks to main gear and lower aircraft and remove jacks.

* * *

## SEQUENCE VALVES - MAINTENANCE PRACTICES

### 1. Removal/Installation

Special equipment :-

Door jack clamp .. .. .. HSA 25Y1491A

### A. Remove sequence valve

(1) With the main gear locked down and the wheel well door closed, depressurize the hydraulic system (see Chapter 29, MAIN SYSTEM).

(2) Open the wheel well door manually to its full extent. Fit door jack clamp on door jack ram.

(3) Remove the bolt securing the sequence valve plunger fork-end to the link.

(4) Place a suitable receptacle under the sequence valve and disconnect each hydraulic pipeline. Blank each pipe after disconnection.

(5) Remove the two bolts securing the valve body to the valve support casting.

(6) Remove the valve and fit blanks to the open pipe adapters.

### B. Install sequence valve (Fig.201)

(1) Check the valve body for cracks, damage and corrosion.

(2) Withdraw the valve plunger to its fullest extent and check that the distance between the plunger flange and the valve body is 0.53 in.

(3) Locate the valve on its support casting, fit the valve position adjusting bolt in the central hole (see Fig.201, Detail B) and fit the valve mounting bolts.

(4) Remove the valve and pipeline blanks and connect the pipelines to the valve adapters. Wire-lock union nuts.

(5) Connect the valve plunger fork-end to the mechanism link by fitting the bolt nut and split pin.

(6) With the door held in the closed position, check that there is a plunger overtravel of 0.050 in. to the fully out position.

(7) With the door fully open, check for free overtravel movement of the valve plunger.

(8) If necessary, adjust the valve position by slackening off the valve mounting bolts and re-positioning the valve adjusting bolt and adjusting plate to increase or decrease the gap between the plunger flange and the valve body (see Fig.201, Detail B).

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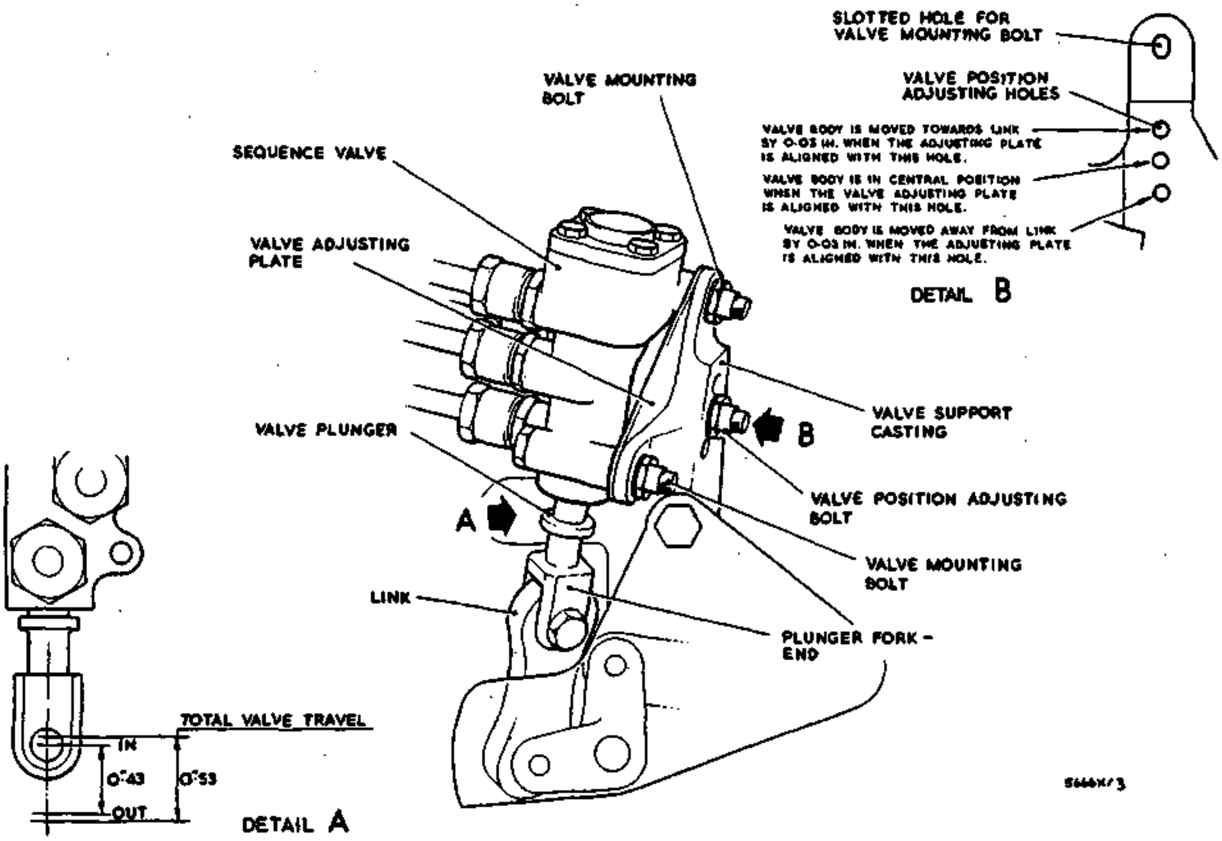
...Sequence valves - Maintenance practices continued

(9) When the correct clearance is obtained, tighten and secure the valve mounting bolts.

(10) Functionally test the landing gear (see Chapter 29, MAIN SYSTEM).

(11) Check the hydraulic pipe connections to the valve for leaks.


SLOTTED HOLE FOR VALVE MOUNTING BOLT
VALVE MOUNTING BOLT
VALVE POSITION ADJUSTING HOLES
VALVE BODY IS MOVED TOWARDS LINK BY 0·03 IN. WHEN THE ADJUSTING PLATE IS ALIGNED WITH THIS HOLE.
SEQUENCE VALVE
VALVE BODY IS IN CENTRAL POSITION WHEN THE VALVE ADJUSTING PLATE IS ALIGNED WITH THIS HOLE.
VALVE BODY IS MOVED AWAY FROM LINK BY 0·03 IN. WHEN THE ADJUSTING PLATE IS ALIGNED WITH THIS HOLE.
VALVE ADJUSTING PLATE
DETAIL B
VALVE SUPPORT CASTING
VALVE PLUNGER
B
VALVE POSITION ADJUSTING BOLT
A
VALVE MOUNTING BOLT
LINK
PLUNGER FORK - END
TOTAL VALVE TRAVEL
IN
0·43
0·53
OUT
DETAIL A
5666X/3

Sequence valve installation and adjustment
Fig.201

* * *

# WHEELS AND BRAKES - DESCRIPTION AND OPERATION

## 1. Wheels

Twin wheels, fitted with tubeless tyres are installed at each of the main and nose gear leg assemblies. Each wheel consists of two half-hubs bolted together; the joint between the halves being sealed by an O-ring seal. The main wheels embody taper roller bearings and run on fixed axle stubs; the nose wheels are splined to a live axle.

Plate type brake units at each main wheel embody segmented rotor assemblies located between pressure, stator and thrust plate assemblies carrying inorganic pads; automatic adjuster assemblies maintain a set working clearance as the friction pads wear.

Fusible plug assemblies in the main wheels release air from the tyre when overheating occurs.

## 2. Brakes system description (Fig. 1 and 2)

Main hydraulic system power is used to operate brake units on the main wheels. Straight line and differential braking is controlled from a brake control valve which, in response to the movement of the toe-operated master cylinders on the rudder pedals, directs the appropriate pressure to the brake units. The normal brakes supply is fed through a twin modulator unit at each leg and through Maxaret anti-skin units mounted in each wheel axle; the emergency supply is taken direct to the brake units.

A handbrake lever on the control pedestal, operating over a notched rack, effects the change-over from normal to emergency braking when moved rearwards to engage the first notch. Further rearward movement of the handbrake lever progressively applies the brakes for parking. The brake control valve and an emergency reducing valve are mechanically connected to the handbrake lever.

A twin pointer indicator, combined with the main hydraulic system pressure indicator in the flight compartment, shows the pressure applied to the left and right brake units during normal application. The indicator is electrically operated from pressure transmitters connected into the supply lines from the brake control valve.

Two magnetic indicators in the flight compartment are controlled by pressure switches connected into the emergency supply to the brake units. During brake pedal operation when emergency braking is selected, the indicators move to ON to show that adequate pressure is being supplied to the respective brake units. The indicators also remind the pilot that braking is direct, that is, with no anti-skid facility.

## 3. Brakes system operation (Fig. 2)

### A. Normal system

Main hydraulic system pressure, backed by the main accumulator, passes through a reducing valve before being made available at the brake control valve normal inlet. With the handbrake lever fully forward, operation of the toe brakes results in operation of the normal valve elements of the brake control valve to supply fluid at the normal outlets at a pressure related to the master cylinder movement.

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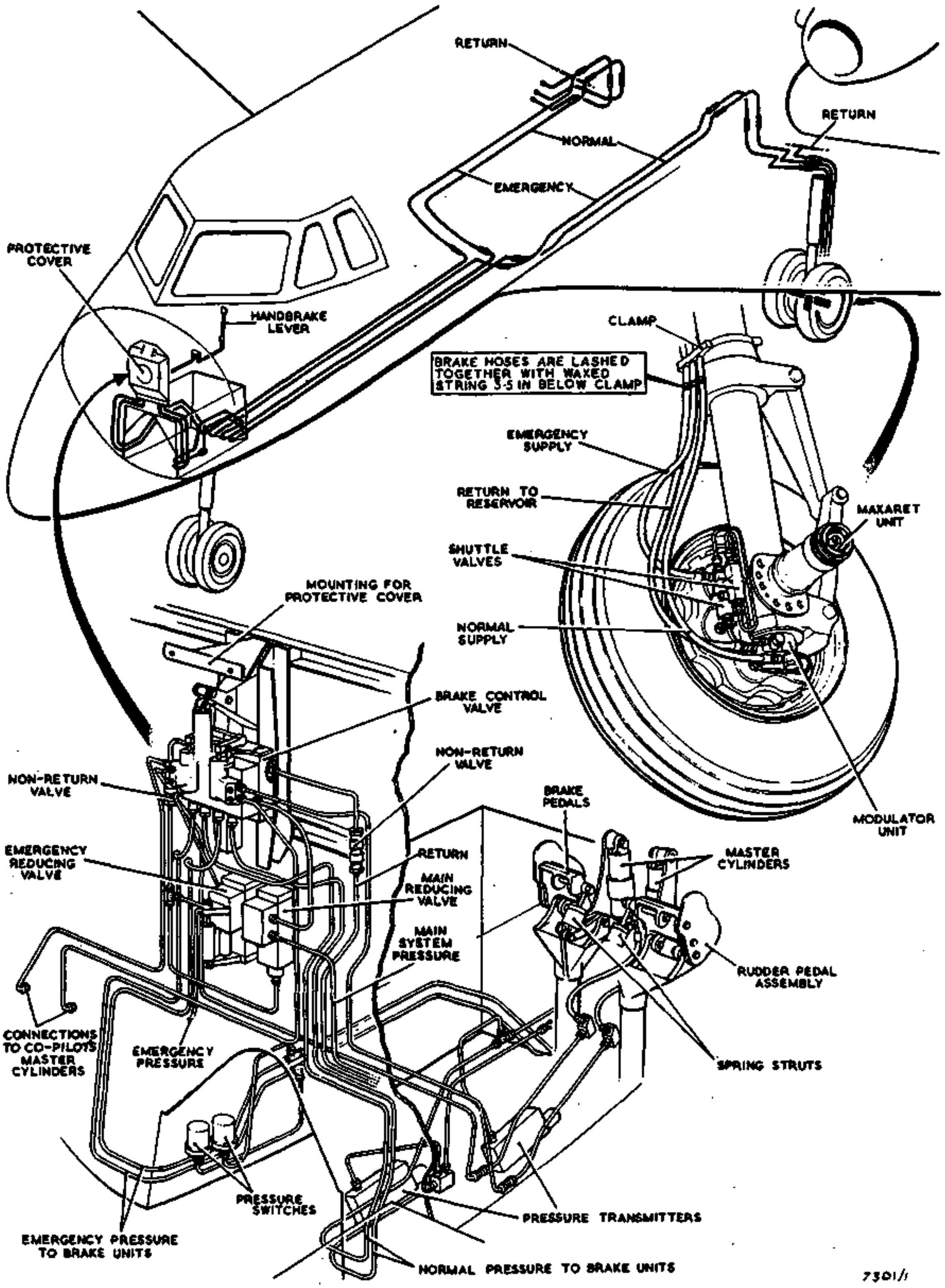

Brake system
Fig.1

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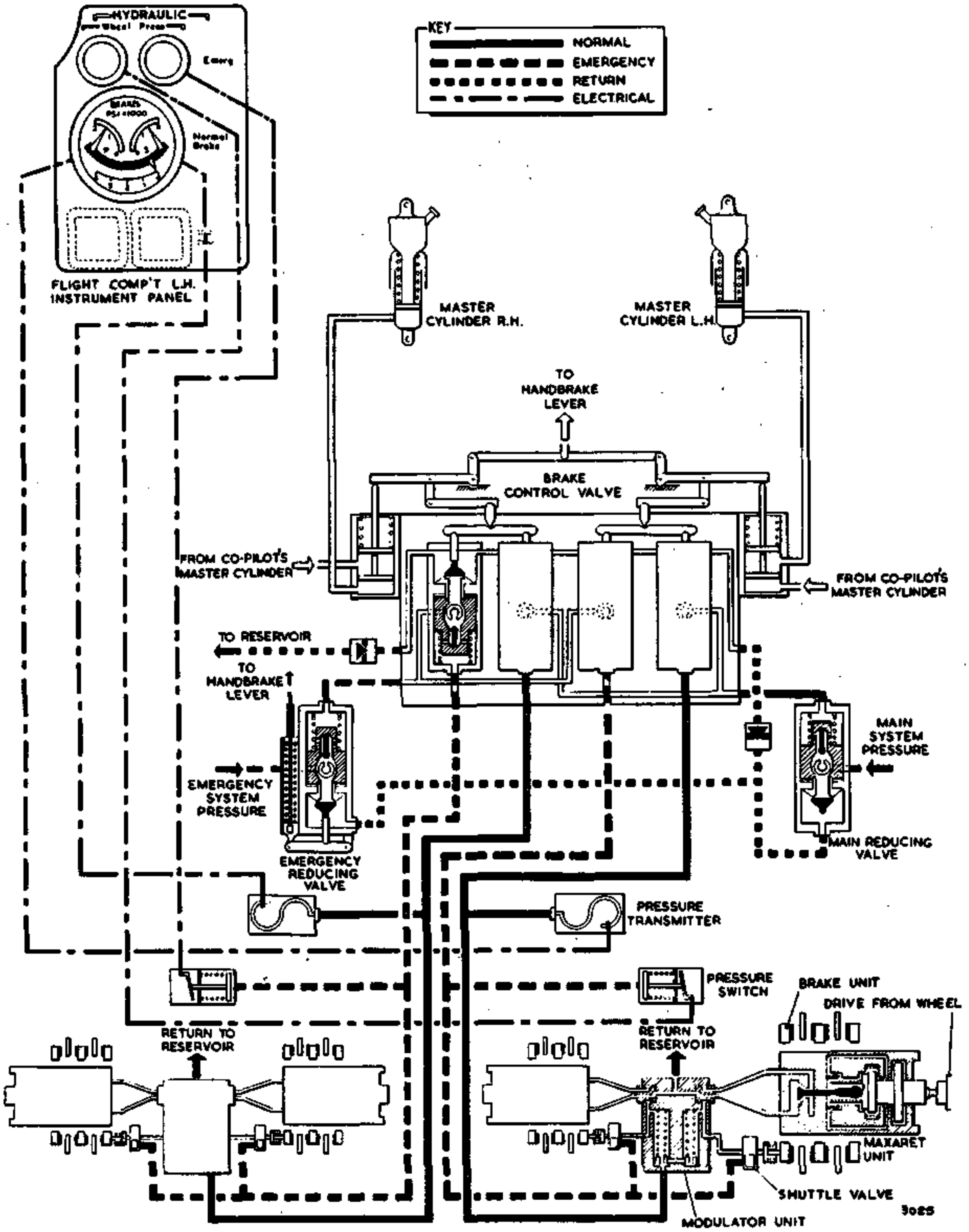


Brake system schematic
Fig.2

...Wheels and brakes - Description and operation continued

From the control valve the supply passes to a twin modulator unit, at the base of each leg, from which connections are made to the brake units via the Maxaret units. The modulator unit ensures that there is an unrestricted flow of fluid to match the capacity of the brakes on initial application and a restricted flow on subsequent operations; the reduced flow conserves main system pressure and enables the brake unit operating pressure to exhaust fully when the associated Maxaret units operate. The Maxaret units permit maximum normal braking effort to be applied to the main wheels, under all conditions, without wheel skidding.

### B. Emergency system

When the handbrake lever is selected to the emergency position, the emergency reducing valve is opened to allow emergency accumulator fluid at reduced pressure to be available at the emergency inlet to the brake control valve. Toe brake application now results in the emergency valve elements of the brake control valve operating to supply fluid to the emergency outlets. The emergency supply line passes directly to the brake units via shuttle valves which blank off the normal supply lines.

### C. Parking

In the parking range, the handbrake lever opens the emergency reducing valve and also operates the lever mechanism of the brake control valve to admit emergency brake pressure to the brake units. The handbrake lever is retained in the set parking position by the engagement of a pawl on the lever with a notched rack.

## 4. Data

| | | |
|---|---|---|
| Main wheel tyre size | ... | 23 x 7.00 - 12. |
| Nose wheel tyre size | ... | 18 x 4.25 - 10. |
| Main wheel tyre pressure) | ... | See Chapter 12. |
| Nose wheel tyre pressure) | | |
| Main reducing valve outlet pressure | ... | 1750 to 1900 lb/sq.in. |
| Emergency reducing valve outlet pressure | ... | 1750 to 1900 lb/sq.in. |
| Emergency brakes supply pressure switch | ... | 950 to 1000 lb/sq.in. (falling).<br>1000 to 1100 lb/sq.in. (rising). |

* * *

## WHEELS AND BRAKES - MAINTENANCE PRACTICES

### 1. Unit Servicing

#### A. Replenish brake master cylinders

NOTE: The master cylinders will be more readily accessible if the rudder pedals are adjusted to the minimum leg length position.

(1) Remove reservoir filler cap and top up to bottom of filler neck, using fluid, Specification DTD.585.

(2) Pump the associated pedal a few times after topping up, and re-check fluid level.

(3) Refit filler cap.

#### B. Prime and bleed brakes system (Fig.201)

NOTE: Before bleed screws are opened, fit length of tubing to the bleed point and then place the open end in a receptacle containing fluid, Specification DTD.585, so that the end is submerged.

Master cylinder controls

Prime and bleed each control as follows:

(1) Ensure that master cylinder reservoir is topped up with fluid.

(2) Open the appropriate bleed screw at the brake control valve piston housing and pump brake pedal until a flow of air-free fluid is obtained from the bleed point. Keep the master cylinder reservoir topped up during this operation.

(3) Tighten the bleed screw during a pressure stroke.

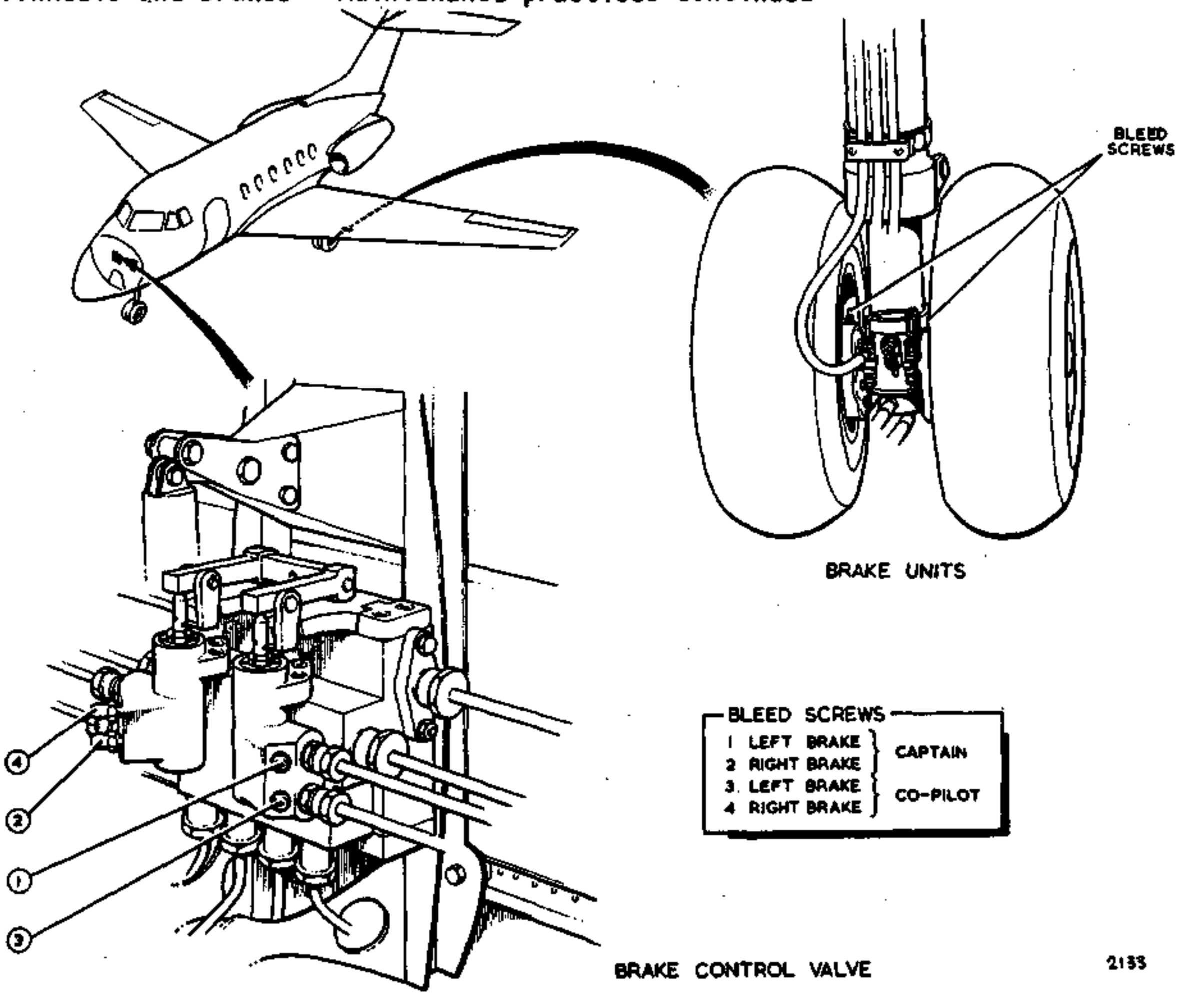
(4) Check the fluid level in the master cylinder reservoir and replenish as necessary.

NOTE: A special primer, Part No.25Y TS119R, can be used to facilitate the preceding priming and bleeding operations.

Normal system

(5) Prime and bleed the master cylinder controls (operations (1) to (4) preceding).

(6) Check main hydraulic reservoir contents and pressurize main hydraulic system.



Bleed screw locations
Fig.201

(7) Open the bleed screws at the brake units and, with the handbrake lever fully forward, apply the brakes by means of the foot pedals until a flow of air-free fluid is obtained from the bleed points. Keep the main system reservoir topped up during this operation.

(8) Tighten the bleed screws during a brake application.

(9) Prime and bleed Maxaret units (see Chapter 32, MAXARET INSTALLATION).

(10) Check the main reservoir fluid level and replenish as necessary (see Chapter 12, HYDRAULIC POWER).

Emergency system

(11) Ensure that the master cylinder controls have been primed and bled. (operations (1) to (4) preceding).

...Wheels and brakes - Maintenance practices continued

(12) Ensure that the emergency system is pressurized and release pressure from the main hydraulic system (see Chapter 29, MAIN SYSTEM).

(13) Place handbrake lever in the emergency position.

(14) Open the bleed screws at the brake units, and apply the brakes by means of the foot pedals until a flow of air-free fluid is obtained from the bleed points. Keep the main reservoir topped up during this operation.

(15) Tighten the bleed screws during a brake application.

(16) Check the main reservoir fluid level and replenish as necessary (see Chapter 12, HYDRAULIC).

## 2. Adjustment/Test

### A. Adjust brake pressure (Fig.202)

(1) Pressurize main hydraulic system.

(2) Set the handbrake lever fully forward (normal).

(3) At each brake pedal, release the locknut at the adjustable stopbolt and unscrew stopbolt a sufficient number of turns to ensure that, with the pedal fully applied, the pressure registered on the relevant brake pressure indicator is below 1750 lb/sq.in.

(4) Screw in the stopbolt progressively until the maximum pressure with the brake pedal fully applied is 1750 - 1900 lb/sq.in. Tighten locknut and lock.

(5) Test normal and emergency brake operation (see sub-paras. B. and C.).

### B. Test normal brake system operation

(1) Pressurize main hydraulic system.

(2) Set the handbrake lever fully forward (normal).

(3) Depress both brake pedals, and check that the pressure in each brake progressively increases to a maximum of between 1750 and 1900 lb/sq.in. as shown on the relevant brake pressure indicator. Repeat checks using brake pedals (if fitted) at second pilots' position.

### C. Test emergency and parking systems operation

(1) Ensure that the emergency system is pressurized and release main system pressure (see Chapter 29, MAIN SYSTEM).

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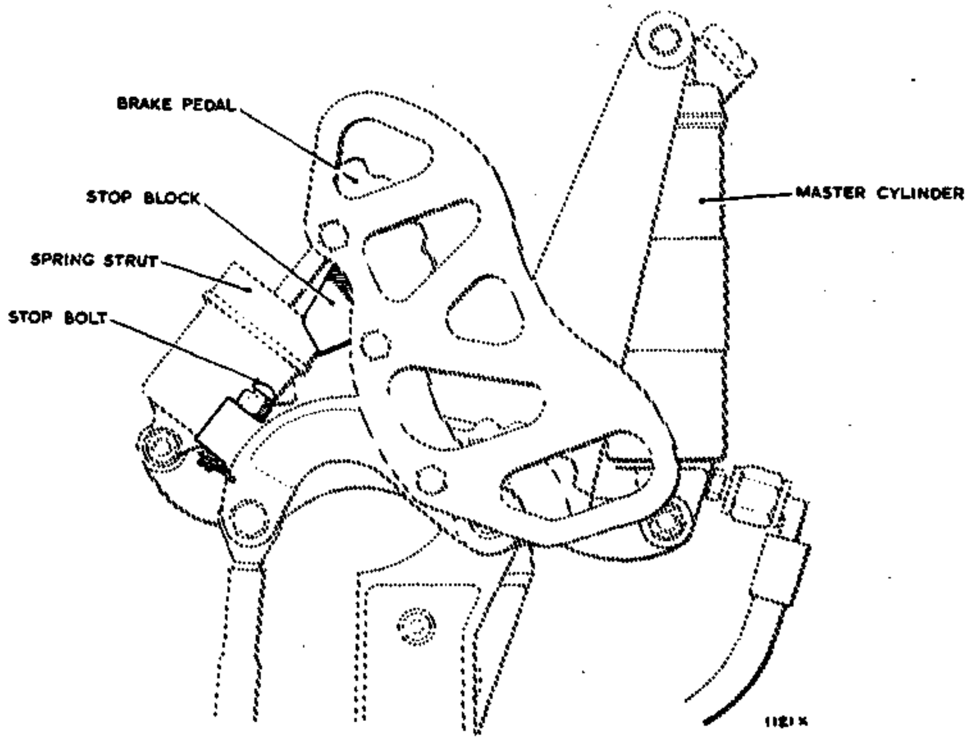


Foot brake control adjustment
Fig.202

(2) Select the handbrake lever to the emergency position (lever in first notch). Operate left and right brake pedals, and check that the relevant emergency brake indicator moves to ON when brake is applied and presents a blank signal face when brake is released.

(3) Move handbrake lever back to the park position, and check that both emergency brake indicators move to ON.

## 3. Inspection/Check

### A. Check operating pressures at brake units

(1) Using suitable adapters, connect a 0 to 3000 lb/sq.in. pressure gauge to a bleed point on each of the wheel brake units.

(2) Pressurize main hydraulic system (see Chapter 29, MAIN SYSTEM).

...Wheels and Brakes - Maintenance practices continued

(3) Set the handbrake lever fully forward (normal).

(4) Depress both brake pedals, and check that the pressure at the relevant brake unit increases to between 1750 and 1900 lb/sq.in.

(5) Release main system pressure.

(6) Set the handbrake lever to the emergency position (lever in first notch) and gradually apply pressure to left and right brake pedals. Check that the related emergency brake indicator moves to ON when the gauges at the brake units register 1000 to 1100 lb/sq.in.

(7) Depress both brake pedals fully, and check that the pressure at the relevant brake unit is between 1400 and 1900 lb/sq.in. Release pedals slowly, and check that the related emergency brake indicator presents a blank signal face at 950 to 1000 lb/sq.in.

(8) Move the handbrake lever through the parking range, and check that there is a progressive increase in brake pressure, with a maximum of between 1750 and 1900 lb/sq.in. when the lever is in the rearmost notch.

(9) Remove gauges, refit bleed screws and bleed and prime brake units (refer to Para.1B).

### B. Brake drag check

NOTE : This check will only be required when the brake control valve has been disturbed or replaced.

(1) Raise the aircraft on jacks(see Chapter 7, LIFTING AND SHORING).

(2) Pressurize the main hydraulic system (see Chapter 29, HYDRAULIC POWER).

(3) Set the handbrake lever fully forward (normal).

(4) Depress both the brake pedals, and check that the pressure at the relevant brake unit increases to between 1750 and 1900 lb/sq.in. as shown on the relevant brake pressure indicator.

(5) Make sure that the wheels are free to rotate when the brake pedals have been released. If the wheel brakes drag then measure the pressure at the brakes. If the pressure is greater than 28 p.s.i.g then change the brake control valve.

(6) Release the main hydraulic system pressure.

(7) Lower the aircraft off jacks (see Chapter 7, LIFTING AND SHORING).

# MAIN WHEEL - SERVICING

## 1. Main wheel servicing

**WARNING: ALL MAIN WHEEL SERVICING PROCEDURES MUST BE DONE IN A WHEEL BAY.**

**CAUTION: A WHEEL WITH A BLOWN FUSIBLE PLUG MUST BE SUBJECTED TO THE COMPLETE INSPECTION PROCEDURES DETAILED IN THE APPROPRIATE VENDOR COMPONENT MAINTENANCE PUBLICATION.**

All procedures are as detailed by the vendor (Refer to the appropriate vendor Component Maintenance Manual).

# MAIN WHEEL - REMOVAL/INSTALLATION

## 1. Main wheel *(Figure 401)*

**CAUTION: MAKE SURE THAT THE CORRECT MAIN WHEEL IS INSTALLED TO THE AIRPLANE. REFER TO THE ILLUSTRATED PARTS CATALOGUE (IPC) FOR THE PART NUMBER.**

| Equipment/Material | Part/Item No. |
|---|---|
| Jack, wheel change | Refer to Chapter 7, JACKING AND TRESTLING |
| Spanner, wheel retaining nut | 25Y725 |
| Spanner, Maxaret retaining nut | 25Y257A |
| Extractor, wheel | A11262 (Dunlop) |
| Alignment fixture, brake rotors | A11848 (Dunlop) |
| Grease, anti-seize | 002 (Chapter 20-95-11) |

### A. Removal

(1) Raise the complete airplane on jacks, or raise the relevant main leg assembly on jack (Chapter 7, JACKING AND TRESTLING).

(2) Make sure that the emergency brake accumulator is pressurized, and apply the parking brake.

(3) Remove the bolts that secure the Maxaret unit drive plate to the wheel hub and withdraw the flexible drive shaft assembly from the end of the Maxaret unit.

**CAUTION: THE WHEEL RETAINING NUT HAS A LEFT-HAND THREAD.**

(4) Remove the locking bolt which passes through the wheel retaining nut, the Maxaret retaining nut and axle, and remove the wheel retaining nut.

(5) Use the wheel extractor to remove the wheel.

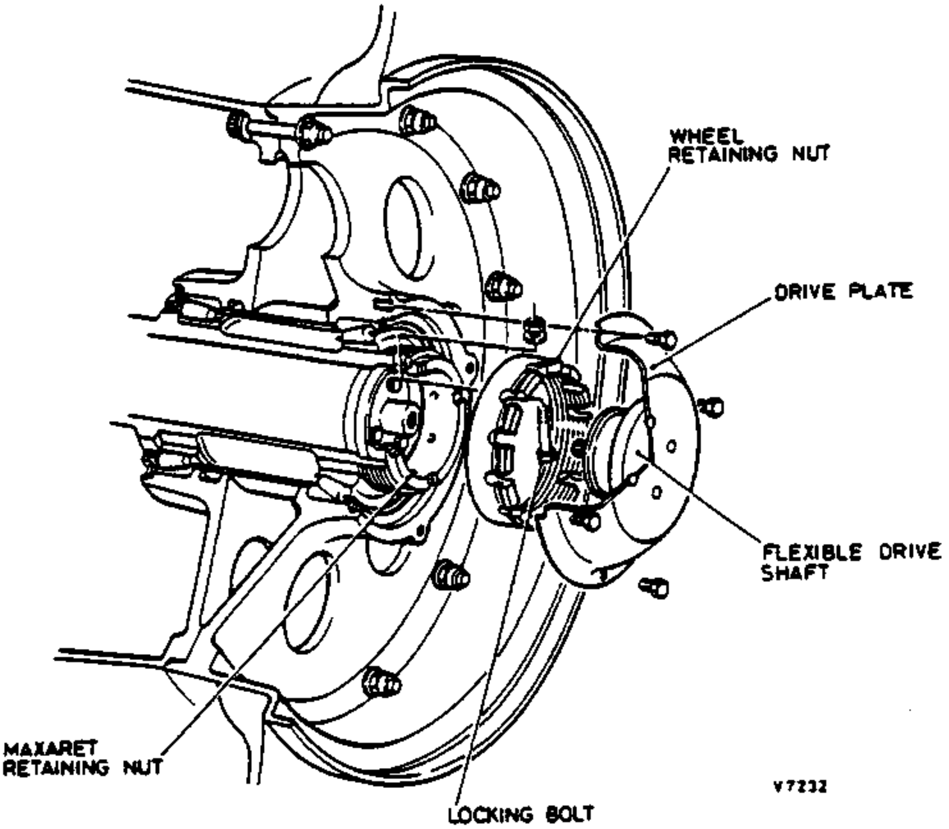
### B. Pre-installation checks

*NOTE: Should the wheel be rejected as a result of these checks, the wheel and tire should be removed as an assembly for repair, in accordance with Dunlop OM 32-40-2.*

*NOTE: Make sure that the wheel bearings are correctly greased.*

(1) Clean the wheel, examine the hub and flange for corrosion and damage. Reject the wheel if corrosion extends below the metal surface of the wheel.

(2) Examine the wheel tie bolts and nuts. Reject the wheel if a tie bolt or related nut is missing or a tie bolt is loose or damaged.



Main wheel - removal and installation
*Figure 401*

(3) Examine the inflation valve, make sure that it is correctly assembled and not damaged.

(4) Examine each fusible plug assembly (Qty. 3 each wheel). Make sure the fusible inserts are serviceable and that the plugs are not damaged.

(5) Examine the tire (TIRES (MAIN AND NOSE WHEELS) ).

(6) Make sure that the tire pressure is correct (Chapter 12, SERVICING - LANDING GEAR), that the valve assembly is secure and the wheel has been serviced.

## C. Installation

**CAUTION: MAKE SURE THAT THE CORRECT MAIN WHEEL IS INSTALLED TO THE AIRPLANE. REFER TO THE ILLUSTRATED PARTS CATALOGUE (IPC) FOR THE PART NUMBER.**

(1) Make sure that the wheel axle is clean.

(2) Make sure that the Maxaret unit is correctly installed (MAXARET INSTALLATION) and that a locking hole in the Maxaret retaining nut aligns with a hole in the axle.

(3) Install the wheel to the axle, positioning the brake rotors so that their tenons engage with the drive blocks on the wheel.

*NOTE: If the brake rotors have been retained in position by brake application (refer to wheel removal) release brakes after installing wheel to axle. If necessary, re-align the brake rotors using the alignment fixture.*

**CAUTION: THE WHEEL RETAINING NUT HAS A LEFT-HAND THREAD.**

(4) Lightly apply grease (Item 002) to the threads and abutment face of the wheel retaining nut. Screw on the wheel retaining nut, using the wheel retaining nut spanner, and tighten to a torque load of 120 lb.ft.

(5) With the wheel brakes released, slacken the wheel retaining nut until the wheel can be freely rotated.

(6) Re-tighten the nut to a torque load of 40 lb.ft., simultaneously rotating the wheel to make sure of improved seating of the bearing assemblies. If the nut is not aligned for locking, continue tightening until the next locking position is reached.

*NOTE: The above torque figures are applicable to Dunlop wheels only. For torque figures on other wheels refer to the relevant Component Maintenance Manual (CMM).*

(7) Make sure the locking bolt and its stiffnut are serviceable. Insert the locking bolt, with its head towards the axle center, through the axle, the Maxaret retaining nut and the wheel retaining nut. Assemble and tighten the nut to the locking bolt, make sure that it is nipped to prevent rotation of the locking bolt, but is not over-tightened. Make sure that the locking bolt head does not foul the Maxaret unit.

(8) With the brakes released, make sure that the wheel is free to rotate.

(9) Smear the spined portion of the flexible drive assembly with grease (Item 002), and enter it into the input shaft of the Maxaret unit. Align the holes in the drive plate with the holes in the wheel and install the bolts. Wire-lock the bolts together.

### D. Close up

(1) Lower the airplane to the ground (Chapter 7, JACKING AND TRESTLING).

(2) Make sure the work area is clean and clear of tools and miscellaneous equipment.

# MAIN WHEEL - INSPECTION/CHECK

## 1. Main wheel inspection/check

**WARNING: ALL MAIN WHEEL INSPECTION/CHECK PROCEDURES MUST BE DONE IN A WHEEL BAY.**

All procedures are as detailed by the vendor (Refer to the appropriate vendor Component Maintenance Manual).

# MAIN WHEEL - CLEANING AND PAINTING

## 1. Main wheel cleaning and painting

**WARNING: ALL MAIN WHEEL CLEANING AND PAINTING PROCEDURES MUST BE DONE IN A WHEEL BAY.**

All procedures are as detailed by the vendor (Refer to the appropriate vendor Component Maintenance Manual).

# MAIN WHEEL - APPROVED REPAIRS

## 1. Main wheel approved repairs

**WARNING: ALL MAIN WHEEL APPROVED REPAIRS PROCEDURES MUST BE DONE IN A WHEEL BAY.**

All procedures are as detailed by the vendor (Refer to the appropriate vendor Component Maintenance Manual).

# NOSE WHEEL - SERVICING

## 1. Nose wheel servicing

**WARNING: ALL NOSE WHEEL SERVICING PROCEDURES MUST BE DONE IN A WHEEL BAY.**

All procedures are as detailed by the vendor (Refer to the appropriate vendor Component Maintenance Manual).

# NOSE WHEEL - REMOVAL/INSTALLATION

## 1. Nose Wheel *(Figure 401)*

### A. Removal

(1) Raise the complete airplane on jacks, or raise the nose leg assembly on jack (Chapter 7, JACKING AND TRESTLING).

(2) Remove the bolts that secure the locking plate and remove the locking plate.

(3) Unscrew the axle nut assembly, complete with the cone retained by the wire ring and remove the wheel.

### B. Installation

| Equipment/Material | Part/Item No. |
|---|---|
| Torque spanner | 60-160 lbf.ft |
| Grease, anti-seize | 002 (Chapter 20-95-11) |

NOTE: *The nose gear is sensitive to differing tire sizes (that is, one new, one part worn). The tire configuration and/or any slight degree of wheel unbalance will result in nose wheel vibration.*

NOTE: *Tires must always be paired only if they are of the same part number. For details of approved tire part numbers, refer to the Illustrated parts catalogue (IPC).*

NOTE: *Make sure that the wheel bearings are correctly greased.*

(1) Make sure that the bolts which retain the splined bush are secure and the tire pressure is correct.

(2) Make sure that the valve assembly is secure with the flanged nut wire-locked to the inflation valve stem.

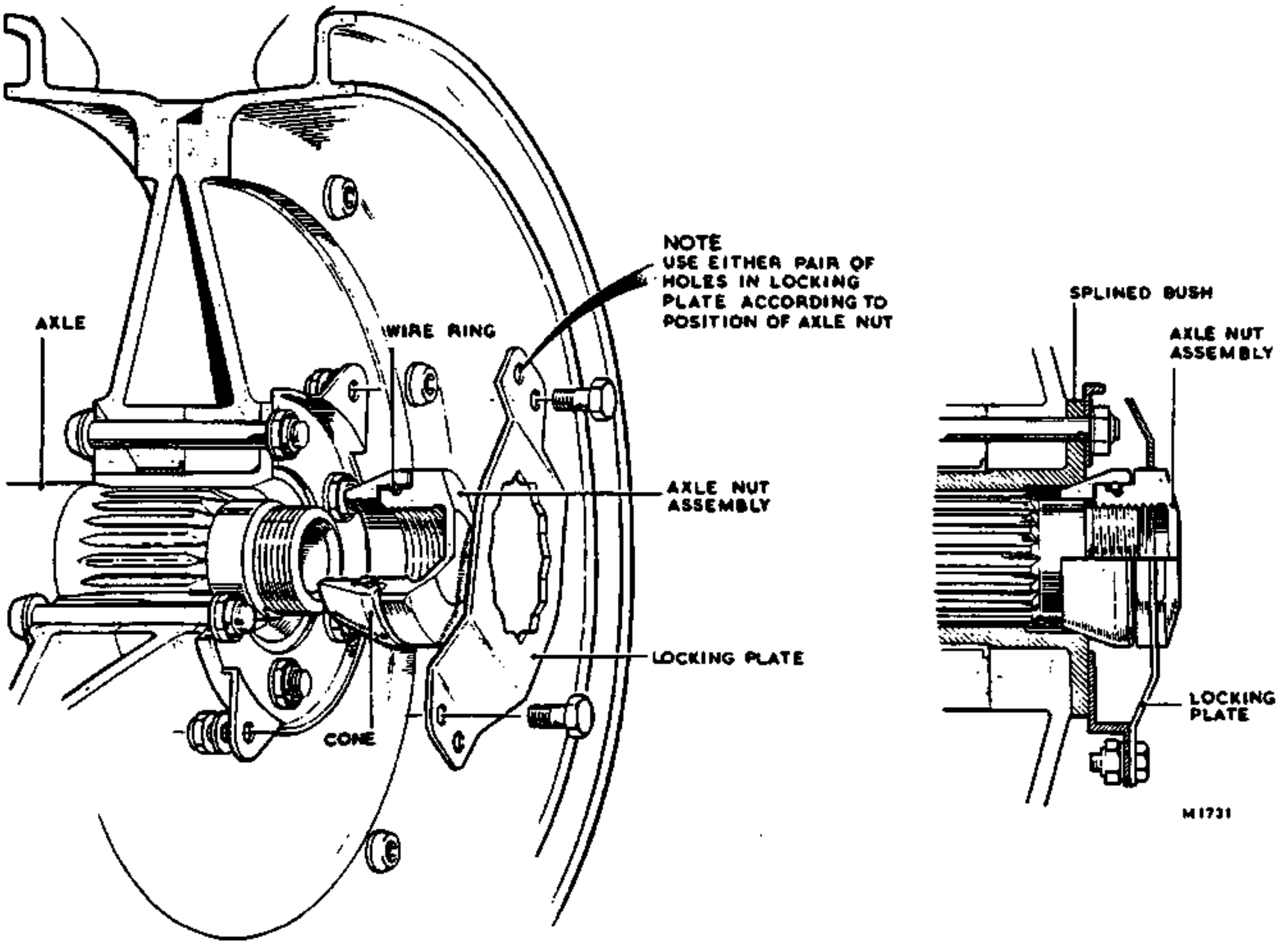
(3) Make sure that the axle is clean and free from damage. Lubricate the axle splines, cone faces and axle nut threads with grease (Item 002). Locate and install the wheel on the axle splines.

(4) Install the axle nut and torque tighten to 70 lbf.ft.

**CAUTION: CHECK TIGHTNESS OF THE AXLE NUT IS TO BE DONE AFTER THE FIRST 3-5 LANDINGS FOLLOWING WHEEL INSTALLATION.**

(5) Install the locking plate and secure with locking bolts and nuts.

NOTE: *To align the locking plate, additional tightening of the axle nut is permissible, provided that the final torque figure does not exceed 150 lb. ft. In extreme cases re-positioning of the wheel on the axle splines may be necessary in order to keep within the torque limitations.*



Nose wheel - removal and installation
*Figure 401*

**C. Close up**

(1) Lower the airplane to the ground (Chapter 7, JACKING AND TRESTLING).

(2) Make sure the work area is clean and clear of tools and miscellaneous equipment.

# NOSE WHEEL - CLEANING AND PAINTING

## 1. Nose wheel cleaning and painting

**WARNING: ALL NOSE WHEEL CLEANING AND PAINTING PROCEDURES MUST BE DONE IN A WHEEL BAY.**

All procedures are as detailed by the vendor (Refer to the appropriate vendor Component Maintenance Manual).

# NOSE WHEEL - APPROVED REPAIRS

## 1. Nose wheel approved repairs

**WARNING: ALL NOSE WHEEL APPROVED REPAIRS PROCEDURES MUST BE DONE IN A WHEEL BAY.**

All procedures are as detailed by the vendor (Refer to the appropriate vendor Component Maintenance Manual).

# NOSE AXLE ASSEMBLY - REMOVAL/INSTALLATION

## 1. Axle and bearings *(Figure 401)*

| Equipment/Materials | Part/Item No. |
|---|---|
| Spanner, axle retaining nut | 25Y239A |
| Grease | 078 (Chapter 20-95-11) |
| Jointing compound | 307 (Chapter 20-95-301) |
| Sealing compound | 314 (Chapter 20-95-301) |
| De-greasing agent | 230 (Chapter 20-95-201) |

### A. Removal

**CAUTION: THE AXLE BARREL MUST BE SEPARATED FROM THE LEG BEFORE THE AXLE IS REMOVED. DAMAGE TO THE AXLE ASSEMBLY COMPONENTS CAN OCCUR IF ANY ATTEMPT IS MADE TO REMOVE AN AXLE INSTALLED ON A LEG.**

(1) Jack complete aircraft (Chapter 7, LIFTING AND SHORING) and remove wheels (Chapter 32, NOSE WHEEL).

(2) Release nitrogen pressure from the leg through the charging adapter.

(3) Disconnect the lower arm of the torque link from the axle barrel by removing the nut, bolt and pin.

(4) Remove the locking bolt and then unscrew the axle barrel retaining nut, using the special spanner.

(5) Remove the locking tab and unscrew the adapter, complete with the charging valve from the leg.

(6) Remove the axle barrel complete with the axle. Remove any sealing compound adhering to the plunger tube, taking care not to damage the chrome plate.

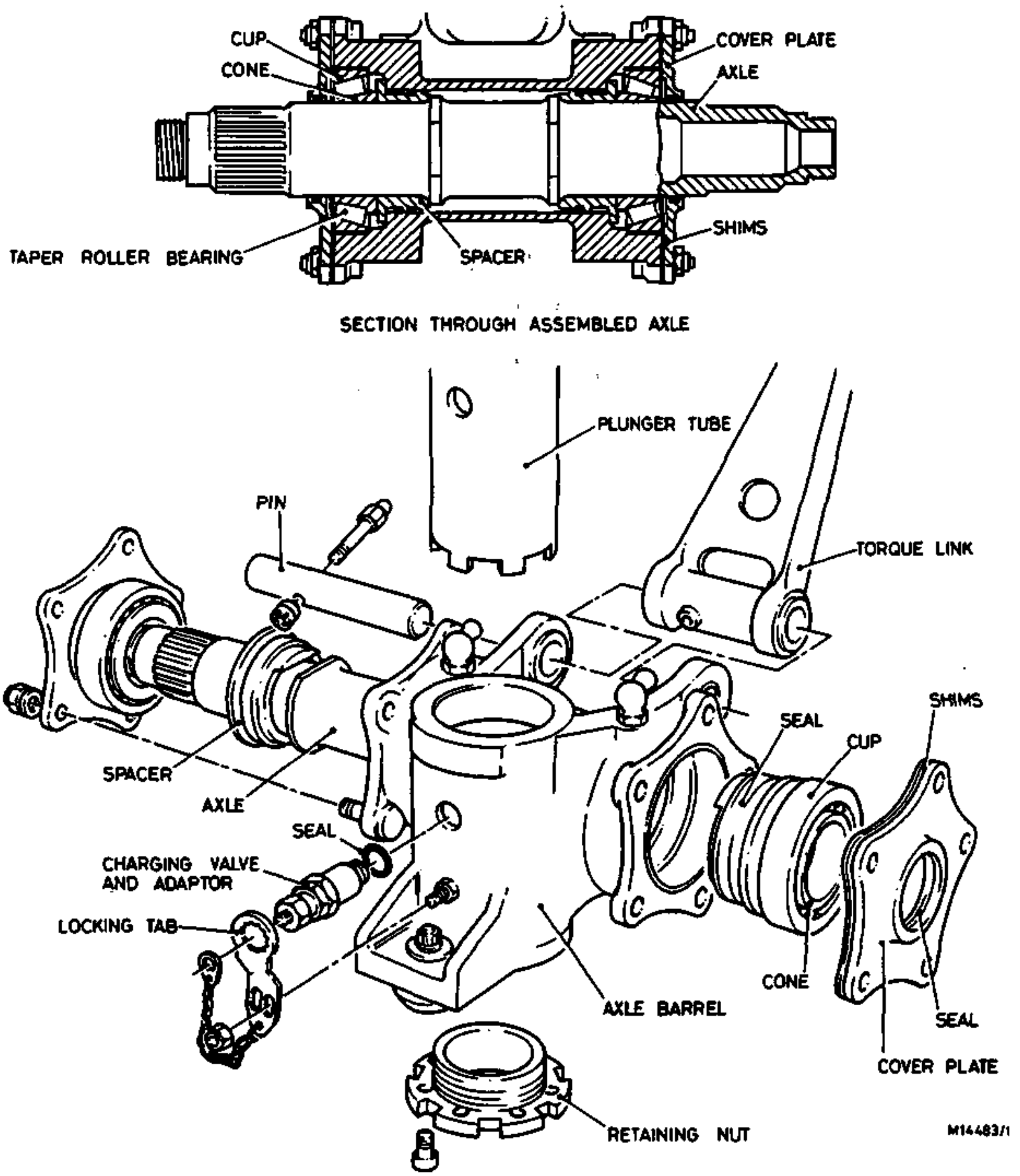
(7) Remove the left-hand cover plate and shims.

(8) Supporting the axle barrel, press the axle from the right side sufficient to remove the left-hand cup.

(9) Remove the right-hand cover plate and, using a suitable mandrel, press the axle from the left side to remove the right-hand cup and axle complete with the right-hand cone and spacer. Remove the left-hand cone and spacer.

**CAUTION: MAKE SURE THE RIGHT-HAND SPACER IS ENGAGED WITH FLATS ON AXLE.**

(10) Using a suitable support under the spacer, press out the axle from the spacer and the right-hand cone.



Nose axle and bearings - removal and installation
*Figure 401*

### B. Installation *(Figure 401)*

*NOTE: Lubricate all taper roller bearings with grease (Item 078). Apply a thin coating of jointing compound (Item 307) to the mating surfaces of the cup and axle barrel before assembly.*

(1) Make sure the axle barrel is clean.

(2) Do a check on the condition of the seals on the spacers and renew as necessary.

(3) Assemble the spacer and press on the cone to the right-hand side of the axle.

(4) Position the axle in the axle barrel and, supporting the axle barrel, press in the right-hand cup.

**CAUTION: MAKE SURE THE SPACERS ARE ENGAGED WITH FLATS ON AXLE.**

(5) Assemble the spacer and press on the cone to the left-hand side of the axle.

(6) Press in the left-hand cup.

(7) Remove the seals from the cover plates. Position cover plate on the right-hand side and tighten the bolts progressively until the bearing is fully home and the cover plate is securely bolted to the barrel flange.

(8) Position the cover plate on the left side and tighten the bolts progressively until there is no end float but the axle is free to rotate. Measure the gap between the cover plate and the axle barrel.

(9) Remove both cover plates. Do a check on the condition of the seals, renewing as necessary, and install the seals to the cover plates.

(10) Secure the cover plates to the axle barrel with the shims under the left-hand plate adjusted to a thickness 0 to 0.003 in. more than the gap measured in paragraph (8). Tighten the cover plate bolts and make sure the axle is free to rotate.

(11) Slide the axle assembly on to the plunger tube, locating the dogs on the plunger tube with the slots in the axle. Make sure the holes in the axle barrel, the plunger tube and the air head are aligned, Install a new sealing ring and screw in the adapter complete with the charging valve. Install the locking tab; secure the tab with a nut.

(12) Install the retaining nut to the plunger tube and tighten, using the special spanner. Lock with a bolt and wire-lock the bolt to the retaining nut.

(13) Insert the pin to connect the torque link to the axle assembly and secure with a bolt, washer and nut. Lock the nut with a split pin.

(14) Charge the leg with nitrogen (Chapter 12, LANDING GEAR).

(15) Clean the joints with degreasing agent (Item 230) and apply a fillet of sealing compound (Item 314) in accordance with 20-10-1002, to the joint between the plunger tube and the axle barrel, and around the charging valve adapter.

(16) Install the nose wheels (Chapter 32, NOSE WHEELS).

# TIRES (MAIN AND NOSE WHEELS) - DESCRIPTION

## 1. General

### A. Main wheel tires

Table 1 lists the main wheel tires applicable to this series of airplane.

**Main wheel part numbers**
**Table 1**

| Manufacturer | Tire number | Speed rating |
|---|---|---|
| Dunlop | DR14626T | 210 |
| Dunlop | DR14628T | 210 |
| Dunlop | DR14630T | 210 |
| Goodyear | 237K03-2 | 210 |
| Goodyear | 237K23-2 | 210 |
| Michelin | 033-505-1 | 210 |
| Michelin | 033-504-0 | 210 |

### B. Nose wheel tires

Table 2 lists the nose wheel tires applicable to this series of airplane.

**Nose wheel part numbers**
**Table 2**

| Manufacturer | Tire number | Speed rating |
|---|---|---|
| Dunlop | DR6385T | 190 |
| Goodyear | 181K63-2 | 210 |
| Michelin | 031-595 | 210 |

**CAUTION: THE MARKINGS SHOWN IN *Figure 1* ARE REPRESENTATIVE ONLY. THE DATA DOES NOT APPLY TO TIRES FOR THIS AIRPLANE.**

This topic gives an example of Dunlop tire identification and markings. For alternative tires refer to the Illustrated Parts Catalogue and the relevant manufacturers Maintenance Manual.

Tire markings are imprinted on the tire sidewall. The markings provide data on:

- Part number
- Date of manufacture and serial number
- Tire size
- Load and speed rating

- Symbols
- Awl vents
- Retreads

*NOTE: Markings other than those detailed may be ignored as these are domestic manufacturing references.*

**C. Part number** *(Figure 1)*

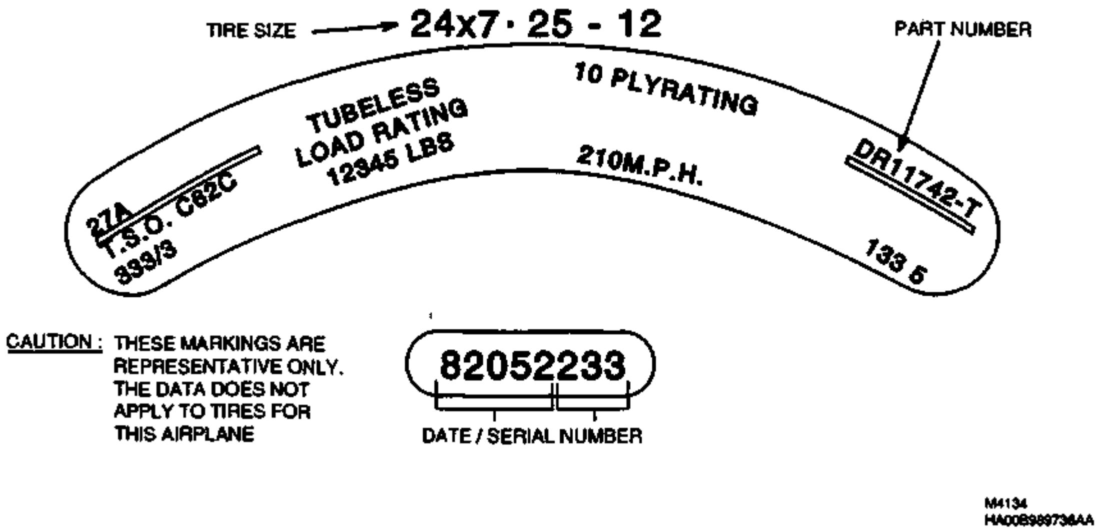
Part number DR11742T indicates the following:

- D - Dunlop
- R - Ribbed
- 11742 - Part number
- T - Tubeless (also imprinted in full on the sidewall)

**D. Date of manufacture and serial number** *(Figure 1)*

Date of manufacture and serial number 82052233 indicates the following:

- 82 - Last two digits of the year of manufacture, 1982
- 052 - Day of year in numerical sequence, Feb.21
- 233 - Serial number of tire



Typical new tire markings
*Figure 1*

**E. Tire size** *(Figure 1)*

The tire size 24 x 7.25 - 12, indicates the dimensions of the tire, where,

- 24 - Overall tire diameter in inches
- 7.25 - Section width in inches
- 12 - Bead diameter in inches

When only two dimensions are given the X and the - indicate which dimensions are quoted i.e. 24 x 7.25 or 7.25 - 12.

**F. Chined Tires**

The nose wheel tires incorporate a protruding flange or chine located just inside the sidewall shoulder diameter. The chine is profiled to deflect downwards, water displaced by the tire tread, thus reducing the water ingestion hazard on a flooded runway.

**G. Load and speed rating** *(Figure 1)*

The words 'Load Rating' appear on all new tires together with the load in pounds. Additionally, the 'Ply Rating' may also appear on the tire, either imprinted in full or abbreviated as 'P.R', but this information is optional and may be omitted.

Most types of high speed tires will have the speed rating imprinted on the sidewall. High speed tires are those designed for speeds in excess of 160 m.p.h. (257 km/h).

**H. Symbols**

A red spot or triangle on the sidewall indicates the 'light' spot of the tire.

**I. Awl vents**

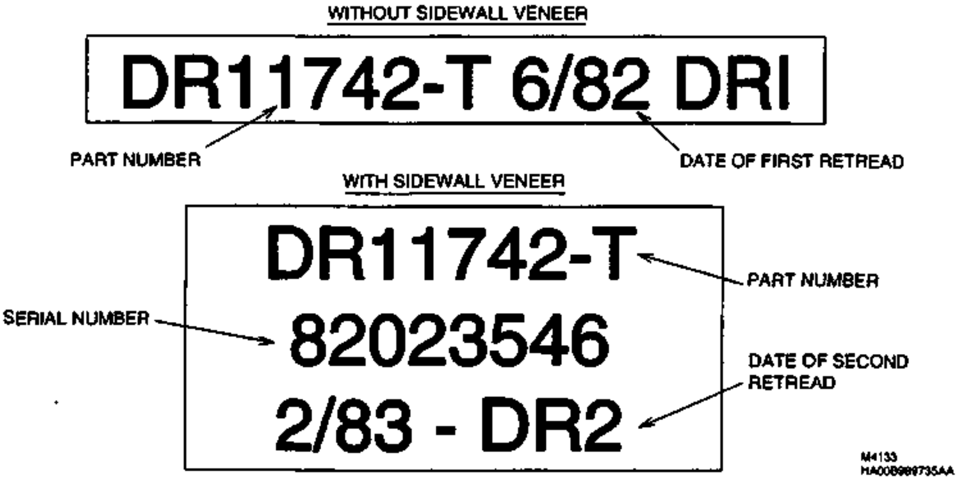
After manufacture there may be air remaining in the casing cords. Air may also collect in the casing by permeation through the inner lining. If a free passage is not provided by awl venting, such air can cause looseness of the casing or rubber lifting from the tread or sidewall of the tire.

Awl vents are part of the manufacturing process. Tubeless tire casings are vented by piercing the outer rubber covering with a 1/16 in. (1.58 mm) awl at several places around the tire immediately outside the wheel flanges. In some cases the crown and shoulder areas are also vented. Each awl vent is identified by a green litho ink mark. The vents permit the release of air under pressure from the tire casing.

**J. Retreads** *(Figure 2)*

Two methods of retreading may be used, with or without a sidewall veneer. With a sidewall veneer the crown, shoulder and sidewall are covered with new rubber. Without a sidewall veneer, only the crown and shoulder are covered. Tires are marked to show how many times the tire has been retreaded and the method of marking indicates whether the last retread was with, or without, sidewall veneer. On the shoulder of all tires retreaded by Dunlop, the words 'RETREAD BY DUNLOP' are embossed together with an alphanumeric code e.g. F2A Where:

- F Fabric layers
- 2 Number of fabric layers
- A Tread design



Typical retread tire markings
*Figure 2*

## 2. Leading particulars

**CAUTION: ON THE MAIN WHEELS AND THE NOSE WHEELS, TIRES MUST BE FITTED IN PAIRS OF THE SAME PART NUMBER.**

| Tire location | Size | Ply Rating | Remarks |
|---|---|---|---|
| Main wheel | 23x7.00-12 | 12 | - |
| Main wheel | 23x7.00-12 | 10 | - |
| Nose wheel | 18x4.25-10 | 6 | Chined |

# TIRES (MAIN AND NOSE WHEELS) - REMOVAL/INSTALLATION

**CAUTION: CONTAMINATION OF THE TIRES WITH HYDRAULIC FLUID, FUEL, OIL OR GREASE MUST BE AVOIDED. THESE MATERIALS HAVE A DETRIMENTAL EFFECT ON RUBBER. CONTAMINANTION MUST BE REMOVED AS SOON AS POSSIBLE USING DETERGENT AND CLEAN WATER.**

## 1. Main wheel tire removal/installation

**WARNING: ALL MAIN WHEEL TIRE REMOVAL AND INSTALLATION PROCEDURES MUST BE DONE IN A TIRE BAY.**

All procedures are as specified by the manufacturer (Refer to the appropriate vendor Component Maintenance Manual).

## 2. Nose wheel tire removal/installation

**WARNING: ALL NOSE WHEEL TIRE REMOVAL AND INSTALLATION PROCEDURES MUST BE DONE IN A TIRE BAY.**

All procedures are as specified by the manufacturer (Refer to the appropriate vendor Component Maintenance Manual).

# TIRES (MAIN AND NOSE WHEELS) - INSPECTION/CHECK

## 1. Main and nose wheel tires inspection/check

**WARNING: DO NOT POINT COMPRESSED NITROGEN TOWARDS CLOTHING, HANDS OR ANY OTHER PART OF THE BODY. INJECTION INTO THE SKIN MUST RECEIVE IMMEDIATE MEDICAL ATTENTION.**

**CAUTION: A WHEEL WITH A BLOWN FUSIBLE PLUG MUST BE SUBJECTED TO THE COMPLETE CHECK PROCEDURES DETAILED IN THE APPROPRIATE VENDOR COMPONENT MAINTENANCE PUBLICATION.**

**CAUTION: CONTAMINATION OF THE TIRES WITH HYDRAULIC FLUID, FUEL, OIL OR GREASE MUST BE AVOIDED. THESE MATERIALS HAVE A DETRIMENTAL EFFECT ON RUBBER. CONTAMINANTION MUST BE REMOVED AS SOON AS POSSIBLE USING DETERGENT AND CLEAN WATER.**

### A. Check and adjust the tire pressure

(1) For main and nose wheel tire inflation check and adjustment procedures refer to CHAPTER 12, SERVICING - LANDING GEAR.

### B. Tread wear check

**CAUTION: A SINGLE TIRE SHOULD BE REPLACED AS SOON AS IT REACHES THE LIMIT DEFINED IN PARAGRAPH B.(1). DO NOT WAIT UNTIL BOTH TIRES ON THE SAME AXLE REACH THE LIMIT OR LESS THAN THE LIMIT BEFORE REPLACING THEM.**

**CAUTION: RAYTHEON RECOMMENDS BALANCING WHEEL ASSEMBLIES AT EVERY TIRE CHANGE AND AT ANY TIME DURING THE LIFE OF THE TIRE THAT THE BALANCE BECOMES SUSPECT DUE TO UNEVEN TIRE WEAR. THE BALANCING OF NOSE WHEELS IS ESPECIALLY SIGNIFICANT TO PREVENT NOSE GEAR VIBRATIONS. THE PROCEDURE FOR WHEEL BALANCING AND THE ADDITIONAL DUNLOP PARTS REQUIRED FOR THIS PROCEDURE ARE DETAILED IN THE APPROPRIATE DUNLOP WHEEL CMM.**

(1) A tire must be replaced when:

*NOTE: The center grooves or the grooves adjacent to the center rib may be used as tread wear indicators.*

*NOTE: A tire worn beyond the defined limit cannot be retreaded.*

- A tire is worn to the base of the groove at any spot.
- At any place around the tire circumference the average depth of the tread grooves across the tire width should be no less than 2 mm. For instance, on a four groove tire, if the center grooves have 1 mm of tread remaining the outer grooves should have at least 3 mm. of tread remaining for the tire to remain on the airplane.

(2) Unless otherwise stated by the appropriate Airworthiness Authority, reject a tire when it is fully worn.

### C. Inspection procedure

(1) Examine the tire tread (paragraph B). Reject a tire which is fully worn.

(2) Examine the tire for signs of overheating. Overheating causes blistering, chafing, melting or early signs of bead failure indicated by defects in the moulding lines near the tire bead. Discard a tire which has been subjected to excessive heat.

(3) Examine the nose wheel tires for cracking along the chine/sidewall junctions. Cracks of up to 0.016 in. (0.40 mm) in depth are permitted. Reject a chined tire which has:

(a) A crack deeper than 0.016 in. (0.40 mm) and more than one inch (25.4 mm) in length.

(b) A crack deeper than 0.093 in. (2.362 mm) at any point.

(4) Examine the general condition of the tire. Use the illustrations in *Figure 602, Figure 603, Figure 604* and *Figure 605* for guidance. Refer to the damage and repair limits given in paragraphs D. and E. for assessment purposes.

### D. Damage limits

(1) Tires damaged within the following limits may be kept in service:

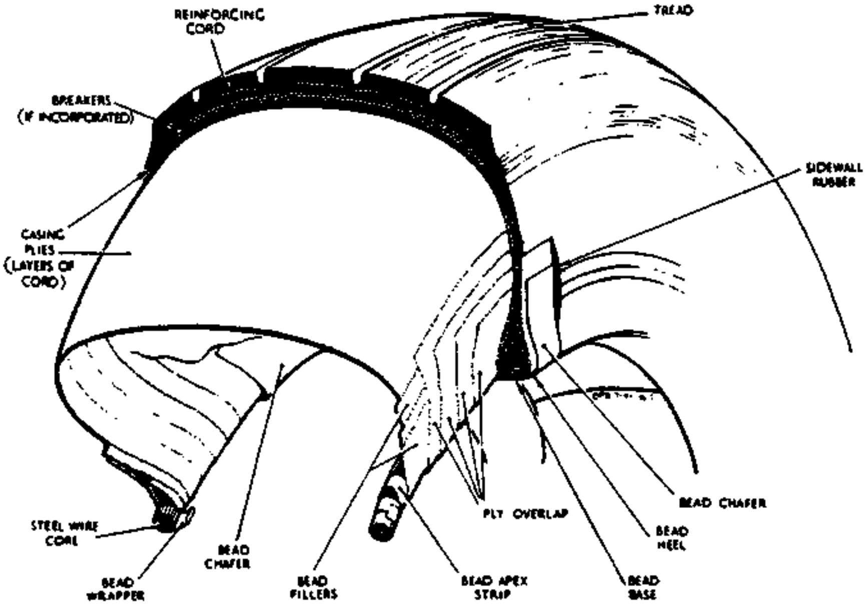
(a) Superficial cuts on the tread and/or sidewall rubber which do not expose the breakers or the cords of the casing plies.

(b) Cracks or splits in the sidewall, if the cords of the casing plies are not exposed *(Figure 602 (3)* and *(4))*.

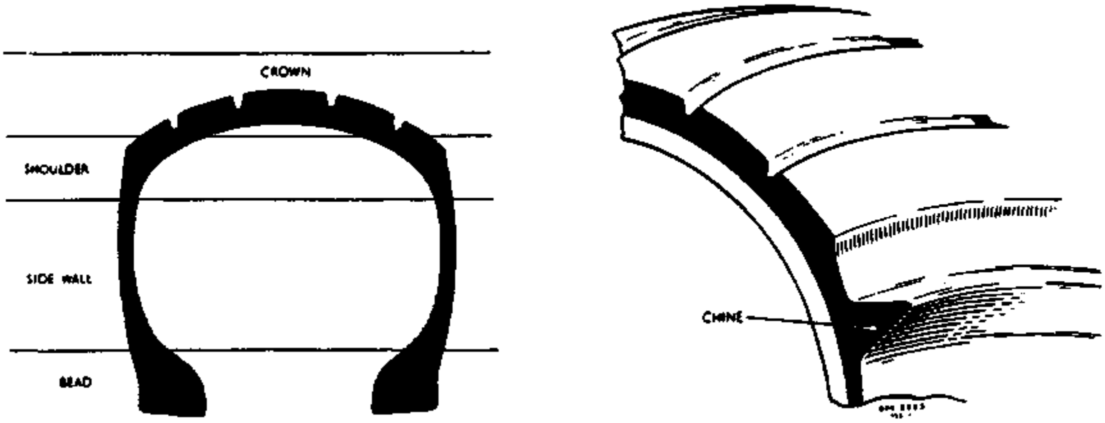
(c) Tires with uneven wear or wear on the shoulder can be kept in service until worn to the base of the tread pattern, or to the limit of wear, whichever occurs first (*Figure 602 (1)* and *Figure 604 (1))*.

(d) Tires which have signs of sideways scrubbing can be kept in service until fully worn *(Figure 604 (3))*.

(e) Skid burns or scalds provided that the damage does not penetrate to the base of the tread pattern or is not likely to cause serious out of balance *(Figure 604 (2))*.



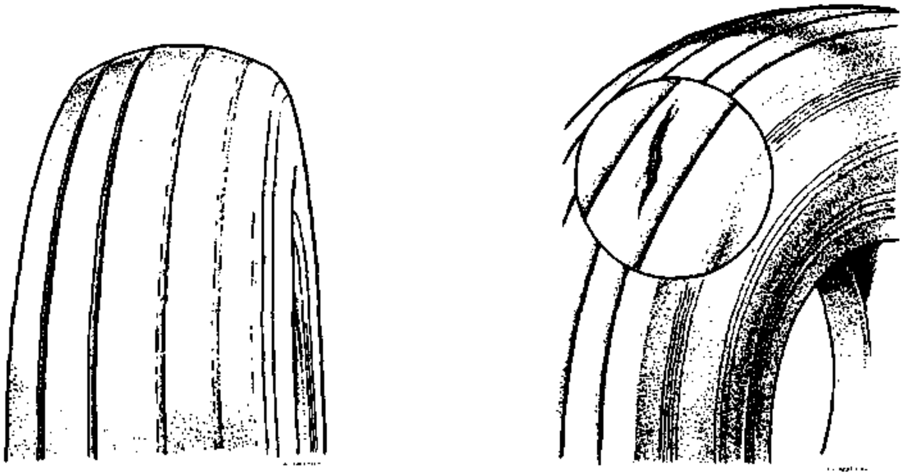
Construction of a typical tyre



Tyre terminology

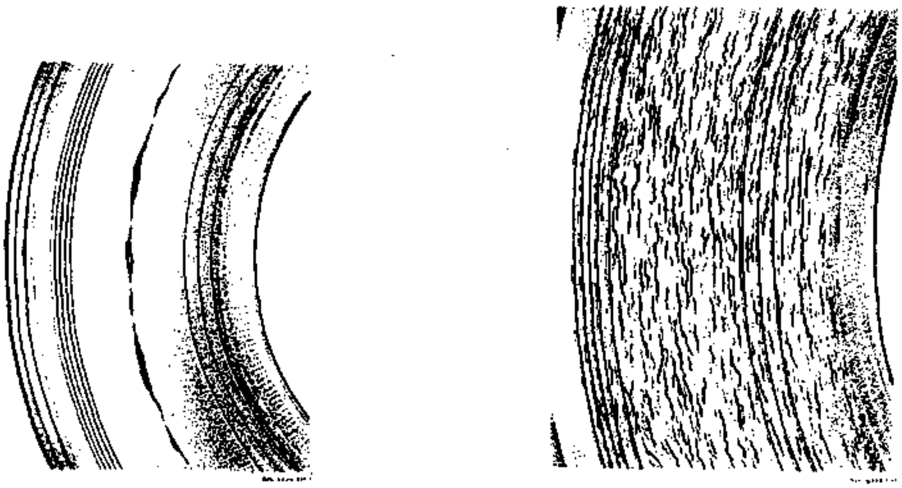
Chine type nose wheel tyre

Tire details
*Figure 601*



UNEVEN WEAR (1)

TYPICAL FLINT CUTS (2)

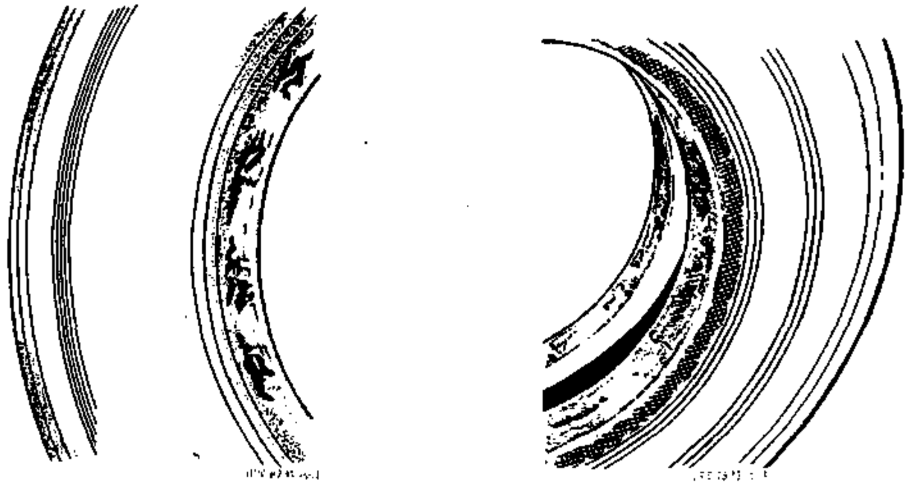


SIDEWALL SPLITS (3)

SIDEWALL CRACKING (4)

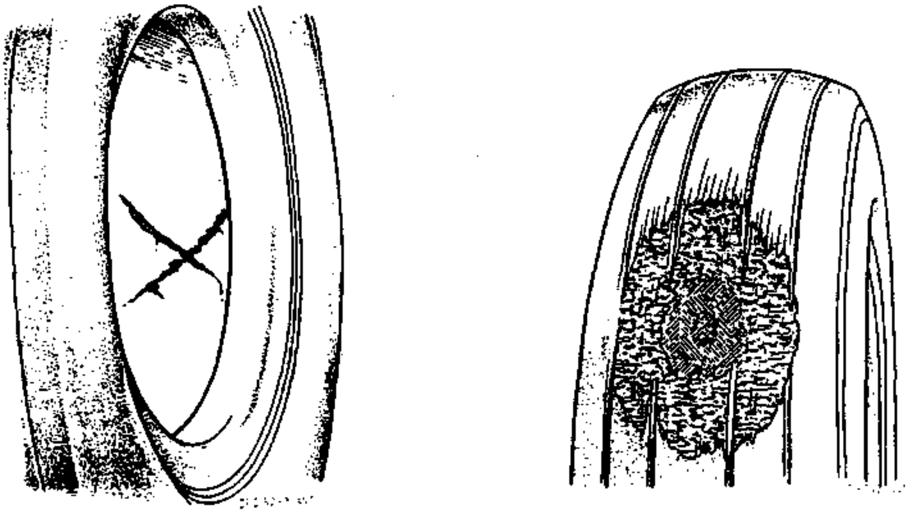
Permissible tire damage

*Figure 602*



BEAD DAMAGE (1)

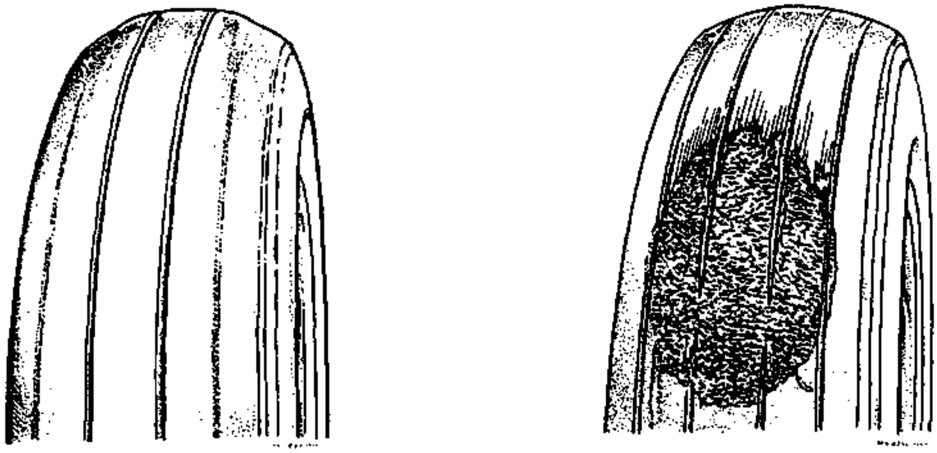
RIM CHAFING (2)



CONCUSSION FAILURE DUE TO IMPACT (3)

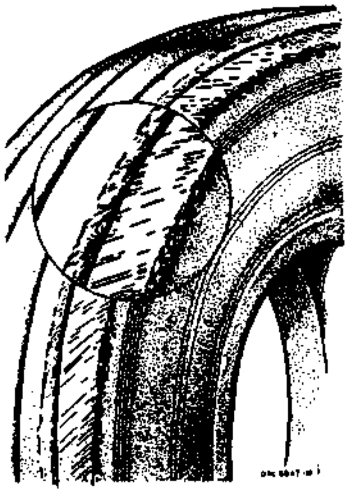
TYRES SCUFFED EXPOSING OR CUTTING CASING CORDS (4)

Reject tire damage
*Figure 603*



EXCESSIVE WEAR ON THE SHOULDER (1)

SKID BURN OR SCALD (2)



SIDEWAYS SCRUBBING (3)

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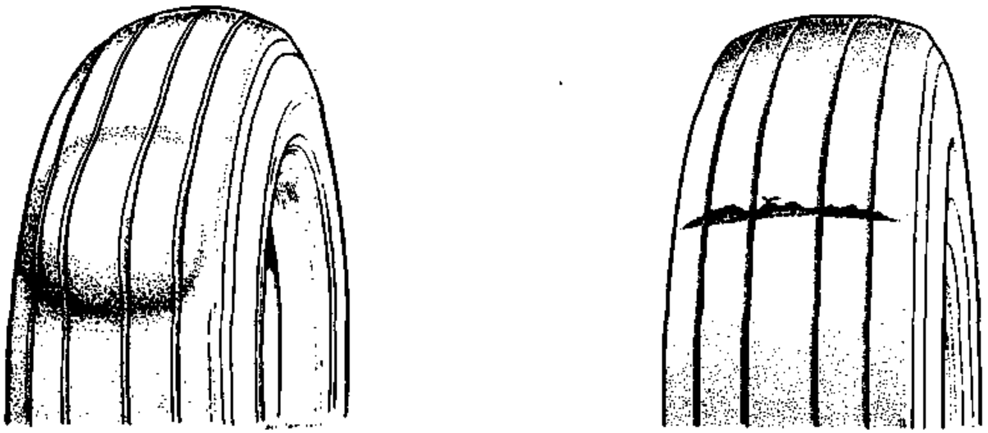
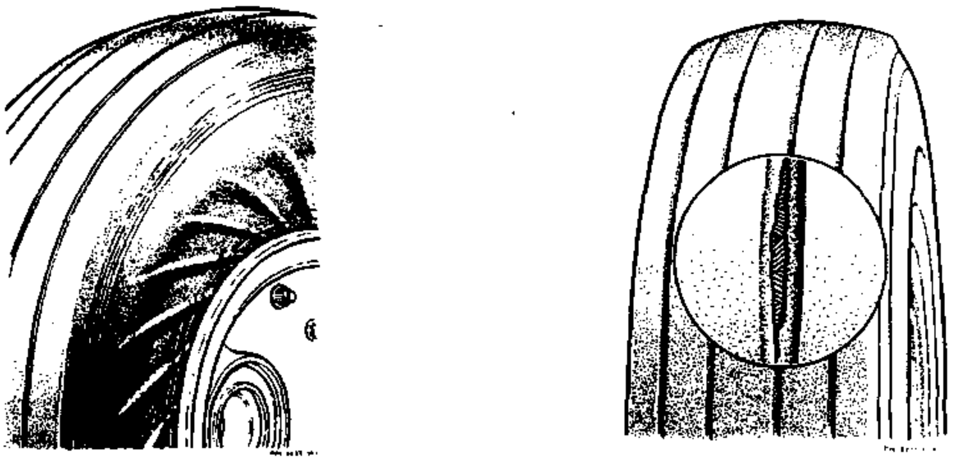
Permissible tire damage
*Figure 604*



BULGES IN THE CROWN AREA (1)

OPEN TREAD JOINT (2)



SIDEWALL CREASING OR BUCKLING (3)

SPLITTING AT BASE OF TREAD GROOVE (4)

Reject tire damage
*Figure 605*

**E. Reject damage** *(Figure 605 and Figure 603)*

(1) Tires with the following damage must be rejected.

(a) Bulges in the crown area.

(b) Open tread joints.

(c) Sidewall creasing or buckling.

(d) Splitting at the base of tread grooves.

(e) Bead damage.

(f) Rim chafing

(g) Concussion damage caused by impact.

(h) Scuffed areas with exposed or cut casing cords.

(i) Rubber blisters located in the upper and lower sidewall

NOTE: *Tires with rubber blisters must be removed and returned to an authorized repair center for inspection and possible repair.*

(j) Cuts in the tread area that exceed the following limits *(Table 601)*. Refer to *Figure 602 (2)*.

Maximum permissible damage penetration

*Table 601*

| Location | Maximum Permissible Damage Penetration |
|---|---|
| | Plies |
| Main Wheel | 2 |
| Nose Wheel | 1 |

i The cut does not exceed 1.50 in. in length, measured in the outer cord layer and not more than 0.50 in. in length, measured at the point of maximum penetration.

ii Any two areas of maximum damage are not less than 60 degrees apart.

NOTE: *Maximum damage is given as a cut through the maximum permitted number of plies detailed in Table 601.*

iii Not more than six repairs to areas of maximum damage are permitted in a tire. Such repairs are identified by a 1.0 in. diameter red disc on the tire lining.

iv Not more than three repairs to areas of non-maximum damage are permitted in any 6 in. square area of a tire. If there are adjacent cuts where, after preparation, all are within the area of a 3.0 in. diameter circle and the maximum ply penetration is not more than half the maximum allowed in *Table 601*, then these cuts can be considered as one damage area.

*NOTE: An area of non-maximum damage is where the damage does not go through the maximum permitted number of plies (refer to Table 601).*

### F. Scrap tires

**CAUTION: A WHEEL WITH A BLOWN FUSIBLE PLUG MUST BE SUBJECTED TO THE COMPLETE CHECK PROCEDURES GIVEN IN THE APPROPRIATE VENDOR COMPONENT MAINTANENCE MANUAL.**

*NOTE: Any tire which has either been subjected to the conditions or has incurred the types of damage given in the following sub-paragraphs must be discarded and replaced.*

(1) Main wheel tires which have been subjected to an abandoned or rejected take-off (R.T.O.) involving above normal energies, as given in the airplane Flight Manual.

(2) Deflated tires together with the companion tire from the same undercarriage leg.

(3) Worn tires over twelve years old.

(4) Overheated tires.

(5) Bulges in the crown area. Refer to *Figure 605 (1)*.

(6) Any damage which goes through all the cord layers.

(7) Creased or buckled sidewall, together with the companion tire from the same undercarriage leg. Refer to *Figure 605 (3)*.

(8) Concussion (impact) failure. Refer to *Figure 603 (3)*.

(9) Oil or fuel soakage.

(10) Casing damage and bead damage in excess of that permitted in paragraph E.

(11) Damage to the sidewall casing plies.

(12) Skid burns or scalds through more than one cord layer. Refer to *Figure 604 (2)*.

# BRAKE CONTROLS - DESCRIPTION AND OPERATION

## 1. Description

### A. General

Foot-operated brake pedals control brake application during normal and emergency operation. The hydraulic power source (normal or emergency) is determined by the position of a hand-operated brake lever which is also used to apply the brakes for parking.

### B. Foot-operated controls

Each rudder pedal assembly incorporates a brake pedal connected to a master cylinder through a spring strut and lever. A stop block on the brake pedal contacts a stop bolt on the rudder pedal when full braking is applied.

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### C. Handbrake lever

A lever on the control pedestal controls the selection of normal, emergency or parking. The emergency position is marked in red on a label adjacent to the lever; the normal and parking ranges are marked in green. A spring-loaded pawl engages in the foremost notch of a rack when emergency brakes is selected. Full parking brake pressure is applied when the pawl is engaged in the rearmost notch. The pawl is disengaged by depressing a release button in the lever handle.

The brake lever is connected by rods and levers to both the brake control valve and the emergency reducing valve. A differential lever and a spring strut in the system ensure that the valves are operated in the correct sequence according to the lever position.

## 2. Operation

### A. Foot controls

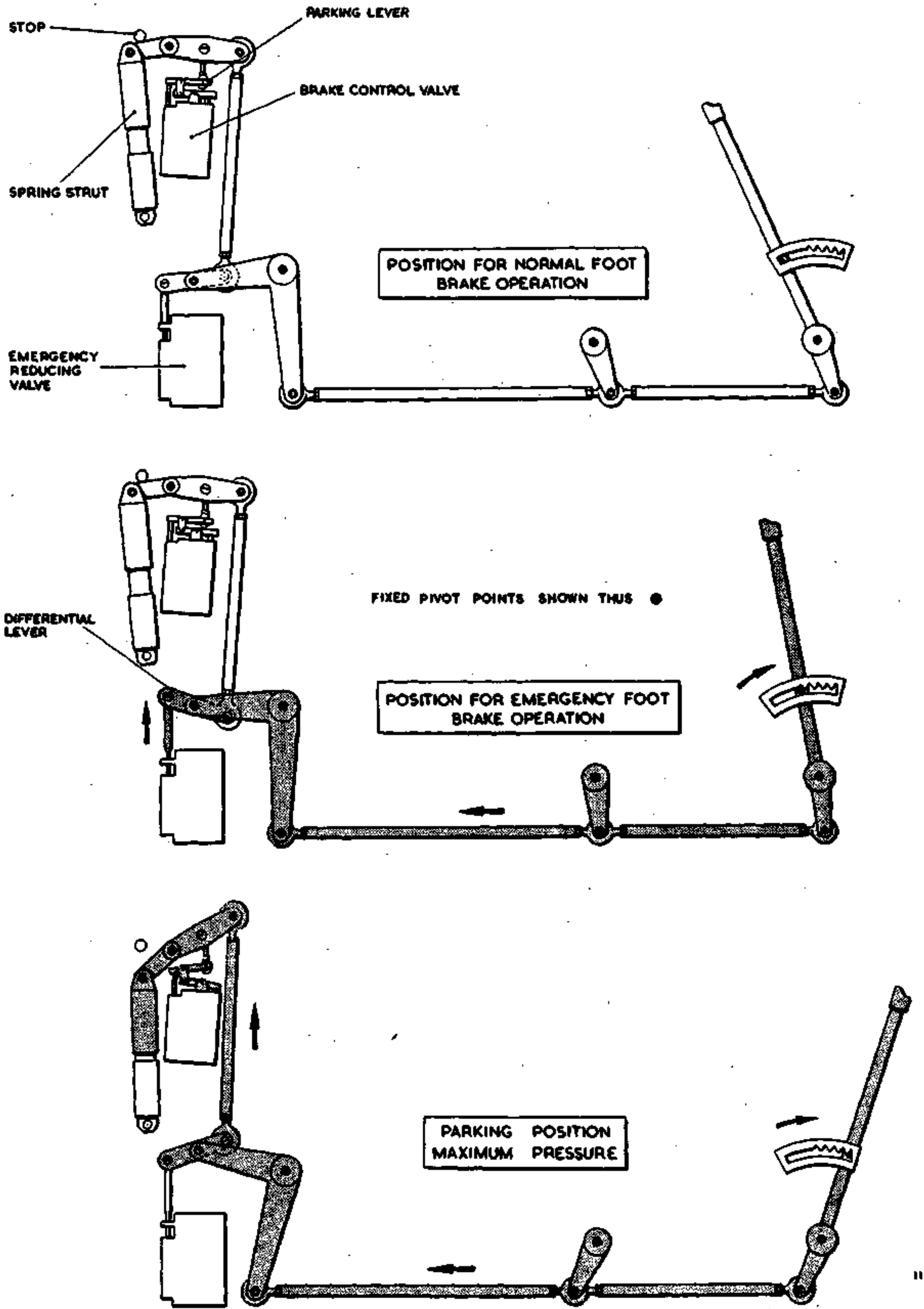
Depression of a brake pedal applies a load, through the spring strut, to the master cylinder. Hydraulic fluid is displaced from the master cylinder to operate the valve elements in the brake control valve, so admitting system fluid to the brake units. The spring strut provides additional foot movement to increase 'feel' and also absorbes the master cylinder movement when back pressure from the brake units closes the valves in the brake control valve.

### B. Handbrake lever (Fig. 1)

In the normal position (fully forward) of the handbrake lever no load is applied to the brake control valve parking lever or the emergency reducing valve.

When the lever is pulled back to the emergency position, the pawl engages in the first notch of the rack; the differential lever, pivoting at the control valve connecting rod, opens the emergency reducing valve via the operating cable.

Further movement of the brake lever back into the parking range progressively lifts the control valve parking lever and loads the spring strut; the differential lever now pivots at the connection to the emergency reducing valve, the valve


STOP
PARKING LEVER
BRAKE CONTROL VALVE
SPRING STRUT
EMERGENCY REDUCING VALVE
POSITION FOR NORMAL FOOT BRAKE OPERATION
FIXED PIVOT POINTS SHOWN THUS ●
DIFFERENTIAL LEVER
POSITION FOR EMERGENCY FOOT BRAKE OPERATION
PARKING POSITION MAXIMUM PRESSURE
1126

Hand brake operation
Fig.1

...Brake controls - Description and operation continued

having fully opened.

When the brake lever is returned to the normal position the controls are re-positioned by the action of the spring strut and the springs in the brake control valve and emergency reducing valve.

* * *

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## BRAKE CONTROLS - MAINTENANCE PRACTICES

### 1. Unit servicing

#### A. Lubrication

For routine lubrication data refer to the Maintenance Schedule.

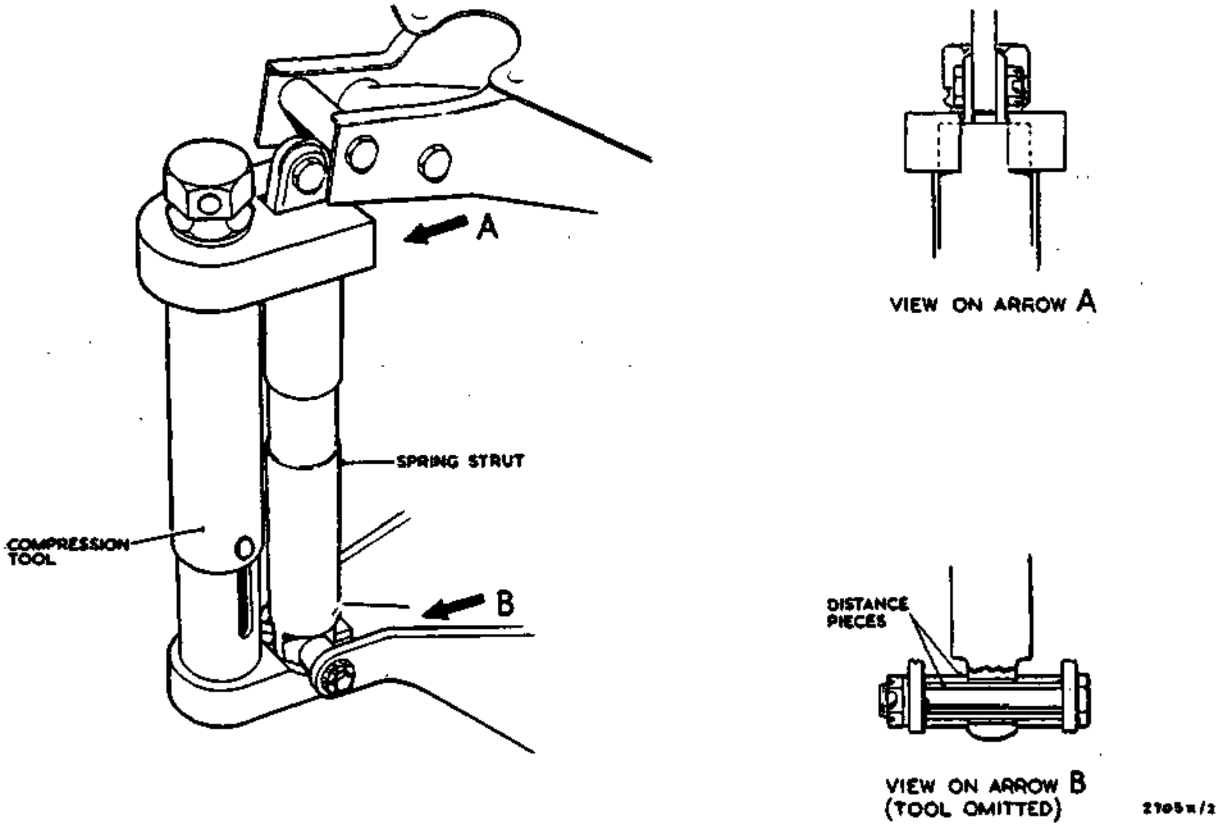
### 2. Removal/Installation

Equipment and materials required :-

| | |
|---|---|
| Compression tool .. .. .. | HSA 25Y1817A or<br>HSA 25Y631A pre mod.256875GE |
| Grease .. .. .. | DTD 5527A |

#### A. Remove spring strut in handbrake control system (Fig.201)

WARNING : THE STRUT IS LOADED TO MORE THAN 90 LB, THE COMPRESSION TOOL MUST BE USED TO CONTROL SPRING EXTENSION DURING REMOVAL OF STRUT.



Handbrake spring strut - removal and installation
Fig.201

...Brake controls - Maintenance practices continued

(1) Release hydraulic pressure in main and emergency accumulators (see Chapter 29, MAIN SYSTEM).

(2) Set handbrake lever on control pedestal to normal position (fully forward).

(3) In nosewheel bay, remove nosewheel mud guard, brake control system protective cover and lower support bracket.

NOTE : On some earlier aircraft it may be necessary to remove an oxygen cylinder to achieve satisfactory access.

(4) Remove split pins and nuts from upper and lower strut pivot bolts.

(5) Pre-mod.25/6875GE : Make provision for collecting residual fluid. Disconnect the brake pipes from the bottom of the brake control unit, release adjacent clamp blocks and move pipes clear of spring strut.

(6) Locate compression tool over spring strut and tighten tool just sufficiently to take spring load.

(7) Remove upper strut pivot bolt. Remove lower pivot bolt; collect washer and distance pieces. Remove strut complete with compression tool.

(8) Unscrew tool to release spring compression.

B. Install spring strut in handbrake control system (Fig.201)

(1) Assemble spring in lower spring cover, pack assembly with grease and assemble upper spring cover.

(2) Locate compression tool over spring strut and tighten to compress spring.

(3) Offer up spring strut complete with tool and adjust tool to enable upper and lower bolts to be inserted.

(4) Insert upper strut pivot bolt. Position the three distance pieces and insert lower strut pivot bolt.

(5) Unscrew and remove compression tool.

(6) Secure upper bolt with nut and split pin and lower bolt with washer nut and split pin. Remove excess grease from spring strut.

(7) Pre-mod.25/6875GE : Reconnect pipes to brake control unit and wire-lock unions, secure clamp blocks. Prime and bleed brake system.

(8) Check handbrake operation (see Chapter 32, WHEELS AND BRAKES).

(9) Install brake control system protective cover and the nosewheel mudguard.

...Brake controls - Maintenance practices continued

C. Remove emergency brake pressure reducing valve

(1) Carry-out operations as at A.(1), (2) and(3).

(2) With reference to Fig.202, unscrew locknut, special nut and barrel which secure valve operating cable assembly to differential lever of handbrake control system.

(3) Disconnect and blank three pipelines and their adapters on valve.

(4) Unscrew four bolts securing valve, with mounting plate, to mounting structure on front pressure bulkhead. Remove valve and mounting plate.

(5) Unscrew four bolts (2 off countersink type heads) securing mounting plate to valve.

(6) Remove pivot pin connecting spring housing hinge plug to valve operating lever. Withdraw hinge plug from spring housing.

(7) Pull out nipple seat sufficient only to disconnect nipple. Remove nipple seat and spring.

(8) Remove operating cable assembly from valve by pulling at cable swaged-end and allowing nipple-end to pass through adjustable stop assembly. Retain cable assembly.

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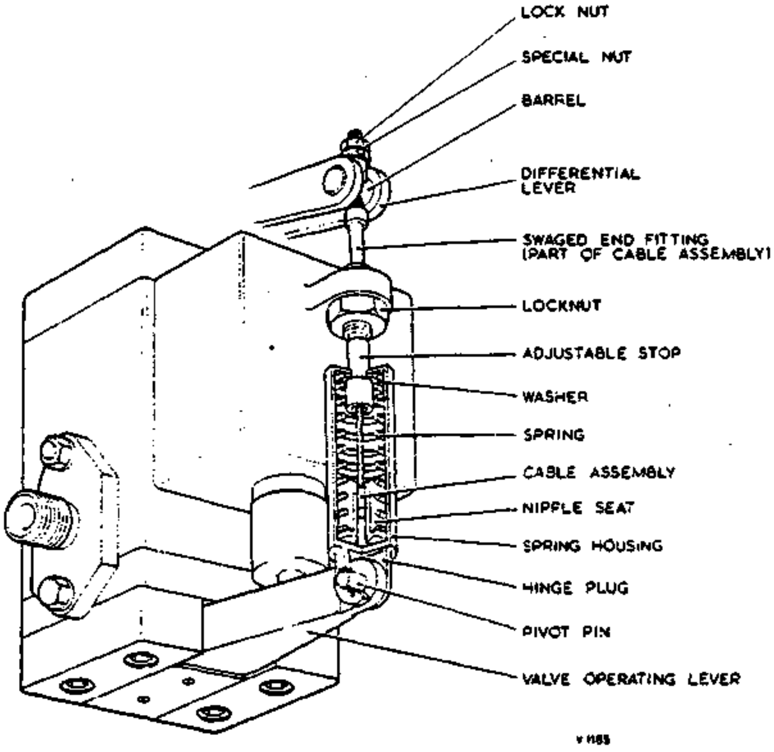
### D. Install emergency brake pressure reducing valve



Installation of operating cable assembly
Fig.202

(1) Prepare new valve by removing pivot pin, hinge plug, nipple seat and spring from spring housing.

NOTE : Do not disturb locknut securing adjustable stop setting.

(2) Carefully pass nipple-end of operating cable assembly through adjustable stop and fit nipple in seat.

(3) Assemble spring, nipple seat and hinge plug into spring housing.

(4) Attach valve operating lever to hinge plug using pivot pin and new split pin.

(5) Securely bolt mounting plate to valve.

(6) Offer-up valve to mounting structure on bulkhead and secure with nuts and bolts.

(7) Remove blanks and re-connect, tighten and wirelock pipelines to their respective adapters.

...Brake controls - Maintenance practices continued

(8) Assemble operating cable and fitting to differential lever using barrel, special nut and locknut.

(9) Do the brake drag check (see para.3.A.) and adjust handbrake controls (see para.3.B.).

(10) Bleed, test and inspect complete wheelbrakes controls system (see Chapter 32, WHEELS AND BRAKES).

## 3. Adjustment/Test

### A. Brake drag check

NOTE : This check is only required when the Emergency Pressure Reducing Valve has been disturbed or replaced.

(1) Raise the aircraft on jacks (see Chapter 7, LIFTING AND SHORING).

(2) Ensure that the emergency system is pressurized and release the main system pressure (see Chapter 29, MAIN SYSTEM).

(3) Select the handbrake lever to the emergency position (lever in first notch).

(4) Apply the brakes by use of the foot pedals and check that the wheels do not rotate.

(5) Release the brakes and make sure that the wheels are free to rotate.

(6) Set the handbrake lever fully forward (normal).

(7) Lower the aircraft off jacks (see Chapter 7, LIFTING AND SHORING).

### B. Adjust handbrake controls (Fig.203)

(1) Set handbrake lever in normal position (fully forward).

(2) Remove right-hand side cover of control pedestal and brake controls cover on forward face of front pressure bulkhead.

(3) On initial installation of connecting rod A, check that pin centre length is 9.57 in. (dimension A).

(4) Check that dimension B is 1.78 in. Adjust as necessary on connecting rod B.

(5) Disconnect brake control valve connecting rod C at upper end.

...Brake controls - Maintenance practices continued

(6) Check that, with differential lever aligned with pivot lever, the emergency reducing valve is fully in with operating cable just taut. The alignment of differential lever is determined by sighting pin centre of connecting rod C through rigging hole in pivot lever. Adjust as necessary on special nut at end of cable assembly; lock the nut.

(7) With brake control valve lever held on its stop by spring strut, check that parking levers and connecting link on brake control valve are down in the fully released position. Adjust as necessary on fork end at connecting link.

(8) Maintaining differential lever in alignment with pivot lever (see operation 6) and brake control lever on its stop, adjust connecting rod C as necessary and connect to brake control valve lever.

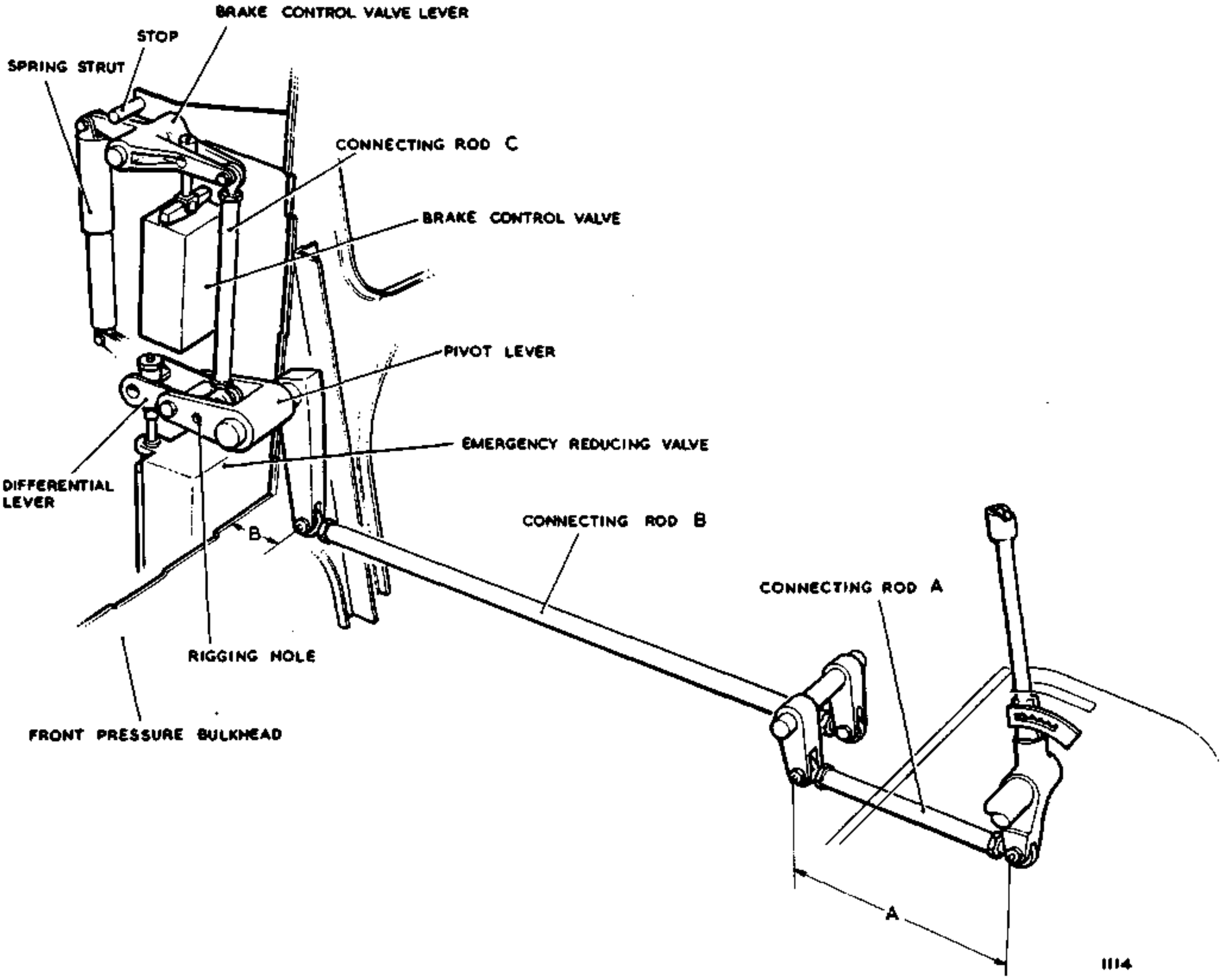
(9) Move handbrake lever back to emergency position and check that the travel of emergency reducing valve is 0.625 in. maximum and that there is no movement of brake control valve connecting rod.

(10) Move handbrake lever back to full park position, and check that the travel of brake control valve mechanism, measured at fork end, is 0.5 in. maximum.

(11) Check that rod ends at all disturbed joints are in safety and wire-lock. Refit covers.

(12) With hydraulic system pressurized, check handbrake operation (refer to Chapter 32, WHEELS AND BRAKES).

...Brake controls - Maintenance practices continued



Handbrake control adjustment
Fig.203

## MAIN REDUCING VALVE - TROUBLE SHOOTING

| Fault | Possible cause | Rectification |
|---|---|---|
| Leakage from the joint faces. | Looseness of attachment screws or defective joint face sealing ring. | Tighten loose screws, but not excessively. If leak persists renew appropriate joint face seal. See Dunlop Overhaul Manual DM.1339. |
| Leakage past the adjusting screw threads. | Defective adjusting screw sealing ring. | Renew sealing ring. See Dunlop Overhaul Manual DM.1339. |
| Loss of system pressure due to internal leakage. | Faulty inlet valve, exhaust valve, or exhaust valve sealing ring. To verify internal leakage, disconnect at the exhaust connection, apply maximum supply pressure to the inlet and check for a continuous seepage of fluid from the exhaust connection. Continuous seepage will verify internal leakage. | Remove the unit from the aircraft for further investigation and rectification at overhaul base. |

* * *

## BRAKE CONTROL VALVE - TROUBLE SHOOTING

| Fault | Possible cause | Rectification |
|---|---|---|
| Leakage from the joint faces. | Looseness of attachment screws or faulty joint face sealing ring. | Tighten loose screws but not excessively. If the leak persists after tightening, renew the faulty seating ring. See Dunlop Overhaul Manual DM. 1339. |
| Leakage from the plunger orifice or adjusting screw threads. | Faulty sealing ring. | Renew the sealing ring. See Dunlop Overhaul Manual DM.1339. |
| Leakage around the top of piston housings. | Faulty piston seals. | Renew the piston seals. See Dunlop Overhaul Manual DM.1339. |
| Loss of system pressure. | Internal leakage. To verify, disconnect the exhaust connection, and check for a continuous fluid seepage with pressure supplied to valve. Repeat with hand brake lever at full park position. Fluid seepage will verify internal leakage. | Return the unit to overhaul base for testing and rectification. |

* * *

# BRAKE CONTROL VALVE - REMOVAL/INSTALLATION

## 1. Brake control valve *(Figure 401)*

### A. Removal

(1) Make sure the landing gear lock pins are installed and wheel chocks are positioned in front of and behind the main gear wheels.

(2) Release all hydraulic system pressure (Chapter 29, MAIN SYSTEM).

(3) Open the nose landing gear doors (NOSE GEAR DOORS).

(4) Remove the mud guard and the brake control valve cover.

(5) Remove the spring strut in the handbrake control system (BRAKE CONTROLS).

(6) Remove the split pin, washer and shackle pin connecting the brake control valve lever to the connecting link.

(7) Remove the wirelocking and disconnect the pipes on the foot control connections. Install blanks to pipes and valve connections.

(8) Remove the wirelocking and disconnect the brake unit supply pipes at the base of brake control valve. Install blanks to pipes and valve connections.

(9) Remove the wirelocking and disconnect the hydraulic supply and return pipes on the brake control valve. Install blanks to pipes and valve connections.

(10) Remove the wirelocking and remove the bolts (4 off) which attach the brake control valve to the attachment brackets on the front pressure bulkhead.

(11) Remove the brake control valve. If the valve is to be reinstalled, remove and inspect the filter in the return (exhaust) connection. Replace the filter if necessary.

### B. Installation

(1) Position the valve on its mounting brackets on the forward pressure bulkhead, locate and install the attachment bolts. Tighten the bolts and wirelock.

(2) Remove blanks, connect and tighten all hydraulic pipe connections.

(3) Wirelock all pipe connections.

(4) Install the spring strut (BRAKE CONTROLS).

*NOTE: Do not install the valve cover, mud guard or close the doors at this stage.Position the fork end of the brake control valve lever to connecting link and install the shackle pin. Do a rigging check of the handbrake control system (BRAKE CONTROLS). Install a washer and a split pin to the shackle pin.*

(5) Bleed the brake system (WHEELS AND BRAKES).

(6) Do a functional test of the normal, emergency and parking brake systems (WHEELS AND BRAKES).

(7) Do a functional test of the operating pressures at the brake units (WHEELS AND BRAKES). Make sure there is no residual pressure at the brakes when the brakes are selected OFF. Make sure there are no leaks.

(8) Install the lower support bracket, brake control valve cover and nose wheel mud guard.

(9) Close the nose landing gear doors (NOSE GEAR DOORS).

## 2. Brake control valve knife edges

NOTE: *The removal and installation of the knife edges can be done with the brake control valve remaining in-situ.*

NOTE: *Make sure that, during removal, all components are suitably identified so that, during assembly these items are returned to their original positions. Adherence to this procedure should minimize subsequent system adjustments.*

### A. Removal

| Equipment/Materials | Part/Item No. |
|---|---|
| De-greasing agent | 230 (Chapter 20-95-201) |

(1) Make sure the landing gear lock pins are installed and wheel chocks are positioned in front of and behind the main gear wheels.

(2) Release all hydraulic system pressure (Chapter 29, MAIN SYSTEM).

(3) Open the nose landing gear doors (NOSE GEAR DOORS).

(4) Remove the mud guard and the brake control valve cover.

(5) Remove the spring strut in the handbrake control system (BRAKE CONTROLS).

(6) Remove the split pin, washer and shackle pin connecting the brake control valve lever to the connecting link.

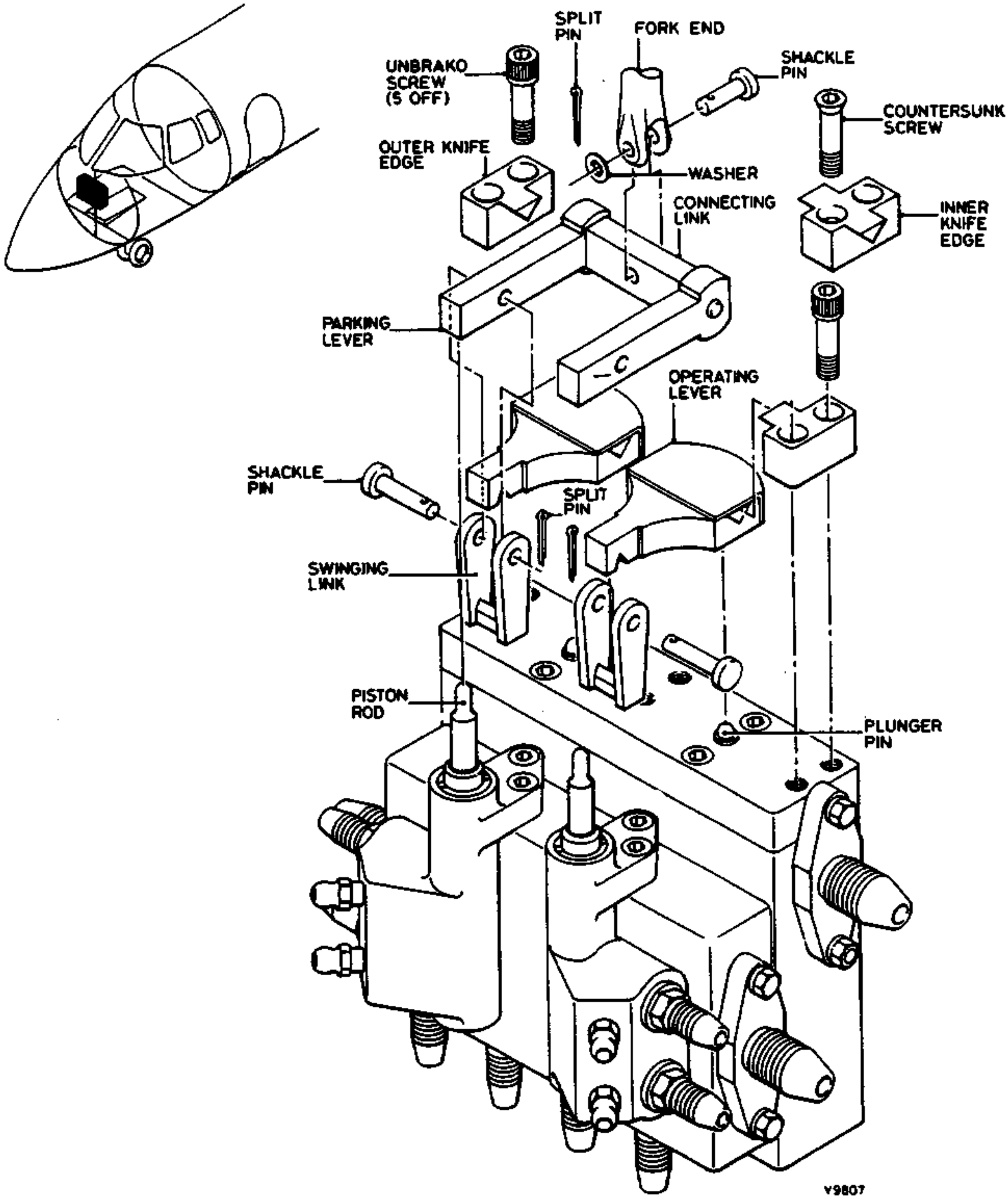
(7) On brake control valve, remove the split pins and shackle pins connecting the swinging links to the parking levers. Remove the swinging links and parking levers complete with the connecting link. Remove the bolts which attach each of the three knife edges and remove the knife edges complete with the operating lever.

(8) Clean all components with a de-greasing agent (Item 230) and make sure the components are dry.

### B. Installation

(1) Assemble the knife edges to the operating lever, position them on the brake control valve and attach with the bolts.

NOTE: *The center knife edge forward bolt is countersunk.*



Brake control valve - removal of knife edges
*Figure 401*

(2) Position the parking levers complete with connecting link on the brake control valve, position the swinging links with their knife edges located under the operating lever. Align the holes in the swinging links and parking levers, install the shackle pins and lock with split pins.

(3) Gently lift at the center point of the connecting link and make sure there is a small amount of free movement of the parking levers before resistance is felt.

(4) Install the spring strut (BRAKE CONTROLS).

*NOTE: Do not install the valve cover, mud guard or close the doors at this stage.*

(5) Position the fork end of the brake control valve lever to the connecting link and install the shackle pin. Do a rigging check of the handbrake control system (BRAKE CONTROLS). Install a washer and a split pin to the shackle pin.

(6) Do a functional test of the normal, emergency and parking brake systems (WHEELS AND BRAKES). Do a check of the operating pressures at the brake units and make sure there is no residual pressure at the brakes when the brakes are selected OFF.

(7) Make sure all disturbed joints are secure and correctly locked.

(8) Install lower support bracket, brake control valve cover and the nose wheel mud guard.

(9) Close nose landing gear doors (NOSE GEAR DOORS)

## MODULATOR UNIT - TROUBLE SHOOTING

| Fault | Possible cause | Rectification |
|---|---|---|
| Sluggishness in operation of the associated brakes. | Blocked filter. | Renew filter. See Dunlop Overhaul Manual DM. 1339. |
| Fluid leakage from end cap and/or connection assembly. | Looseness of end cap and/or connection assembly or unserviceable O-ring seals. | Check end cap and/or connection assembly for tightness. Renew relevant O-ring seal if leakage persists. |

* * *

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## MODULATOR UNIT - MAINTENANCE PRACTICES

NOTE : Modulator units must be removed and installed in conjunction with the associated Maxaret units. (See Chapter 32, MAXARET INSTALLATION).

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# MAXARET (ANTI-SKID) INSTALLATION - TROUBLE SHOOTING

## 1. Trouble shooting - general

| Fault | Possible cause | Rectification |
|---|---|---|
| Fluid leaks from the bore of the axle. | Faulty sealing between the Maxaret unit and coupling. | Install new external seals to the Maxaret valve block. |
| Fluid leak adjacent to the modulator lock ring. | Faulty sealing between the modulator and coupling. | Install new seals to the coupling connection. |
| Fluid leak from the bore of the axle and/or adjacent to the modulator lock ring. | (a) Leak from Maxaret drain holes (internal Maxaret leak)<br>(b) Faulty sealing between the Maxaret and coupling.<br>(c) Faulty sealing between the modulator and coupling.<br>*NOTE: To find the source of leak, if not apparent, do the procedure given below in Paragraph 2.A.* | (a) Remove the Maxaret for rectification. Return to overhaul base.<br>(b) Install new external seals to the Maxaret valve block.<br>(c) Install new seals and/or back up rings to the coupling. |
| Excessive tyre scuffing, flatting or tyre burst | Defective or incorrectly operating Maxaret unit.<br>*NOTE: To confirm correct operation of the Maxaret unit, carry out the procedure detailed in Paragraph 2.B* | If correct operation of the Maxaret unit is not confirmed, the Maxaret unit should be removed and rectified in accordance with the Dunlop Component Maintenance Manual |

## 2. Trouble shooting - Remedial action

### A. Fluid leakage inspection:

**CAUTION: IF THERE IS AN EXCESSIVE LEAK, MAKE SURE THAT THE WHEEL BEARINGS AND BRAKES ARE NOT CONTAMINATED.**

(1) Remove the suspect Maxaret unit. Remove all traces of oil from within the axle and drain off any residual fluid from the Maxaret unit casing drain holes.

*NOTE: If doubt exists as to which Maxaret unit is leaking, remove the inner and outer units for checking.*

(2) Cover the Maxaret unit drain holes with a rubber band and reinstall the unit to the axle.

(3) Prime the system and leave the installation on test under normal reservoir back pressure (2 to 3 hours if practicable). At the end of the test period carefully examine the installation for leakage at the end of the axle and in the area of the modulator lock ring.

(4) The absence of leakage during test indicates that previous leakage was due to an internal leak in the Maxaret unit. Remove the Maxaret unit, remove the rubber band and check for fluid leakage from the drain holes to confirm Maxaret unit unserviceability.

(5) The presence of leakage during test indicates leakage at either the coupling/Maxaret seals or the coupling/modulator seals. The exact location may be established by careful examination of seals for damage and deterioration, and back-up rings for chipping or other damage.

*NOTE: Excessive internal leakage in the Maxaret unit may produce similar symptoms if fluid floods the unit and comes from around the drive shaft (confirm this condition as in Para.A.(4)).*

(6) Renew the seals, back-up rings or install a serviceable Maxaret, as applicable. Back-up rings which are not a good fit in their grooves should be removed and 'wound down' by hand, to reduce their diameter, then reinstalled.

### B. Maxaret unit test

| Equipment/Materials | Part/Item No. |
|---|---|
| Input shaft key | Dunlop AO 105410 |
| Pressure gauge | 0 to 2,000 psig |
| Anti-seize compound | 002 (Chapter 20-95-11) |

**Test set up**

(1) Connect the 0 to 2000 psig pressure gauge to the brake bleed adapter for the suspect Maxaret unit.

(2) Set the handbrake to NORMAL brakes position.

(3) Make sure the main hydraulic system is pressurized to more than 2000 psi.

(4) Remove the bolts that secure the drive plate to the wheel. Remove the flexible drive coupling.

### C. Test procedure

| Action | Result |
|---|---|
| (1) Depress the toe pedals to set the brakes fully ON. Use the special hand key to turn the Maxaret input shaft briskly in the direction indicated by the arrow, then bring it suddenly to rest. ... | The internal inertia flywheel will continue to rotate through 30° against the torque of a torsion spring until it is mechanically arrested by internal stops. This can be manually felt. |

| Action | Result |
|---|---|
| (2) Monitor the brake pressure gauge at the brake | The gauge pressure momentarily falls below 100 psig and then recovers to full brake pressure as the flywheel returns to its rest position. |
| (3) Repeat the procedure several times for each Maxaret unit. | — |
| (4) Release the toe pedals to release the brakes | The brake residual pressure should be less than 30 psig. |

### D. Job close-up

(1) Remove the input shaft key from the Maxaret unit and the pressure gauge from the brake bleed adapter.

(2) Examine the flexible drive coupling for delamination and deterioration of the rubber component, security of rivets and condition of splines.

(3) Apply a thin layer of anti-seize compound (Item 002) to the splined portion of the flexible drive coupling. Install the assembly into the shaft of the Maxaret unit.

(4) Align the holes in the drive plate with the holes in the wheel and install the bolts. Tighten and wirelock the bolts together.

(5) Make sure the hydraulic reservoir has the correct fluid level (Chapter 12, SERVICING).

## MAXARET INSTALLATION - MAINTENANCE PRACTICES

### 1. Removal/Installation

Equipment and materials required:-

| | |
|---|---|
| Maxaret installation and extraction tool | Dunlop AO 109691 |
| Spanner, Maxaret retaining nut | BAe 25Y257A |
| Spanner, Maxaret ring nut (hydraulic coupling to Maxaret) | Dunlop AO 107745 |
| Modulator alignment tool | Dunlop AM 22574 |
| Spanner, modulator retaining nut (axle to plunger nut) | BAe 25Y249 |
| Input shaft key (for bleeding Maxaret) | Dunlop AO 105410 |
| Grease | DTD 5598 |
| Oil | DTD 822 (MIL-L-6085A) |
| Anti-seize compound | DTD 5617 |
| Sealant, Thiokol PR1301 | DTD 900/4523 |

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A. Remove two Maxaret units and modulator unit (Fig.201)

NOTE : This procedure covers the removal of both Maxaret units on one leg assembly and the associated modulator unit. Omit operations (4) and (5) when removing a single Maxaret unit.

CAUTION : BEFORE REMOVING ANY PART OF THE MAXARET AND MODULATOR INSTALLATION, PROTECT THE WHEEL, TYRE AND BRAKE UNIT AGAINST POSSIBLE CONTAMINATION BY SPILLED FLUID.

(1) Make provision for collecting fluid and blanking off pipelines and connections as they are disconnected.

(2) Disconnect the pipelines to the modulator. Blank off the pipelines immediately to prevent loss of system fluid.

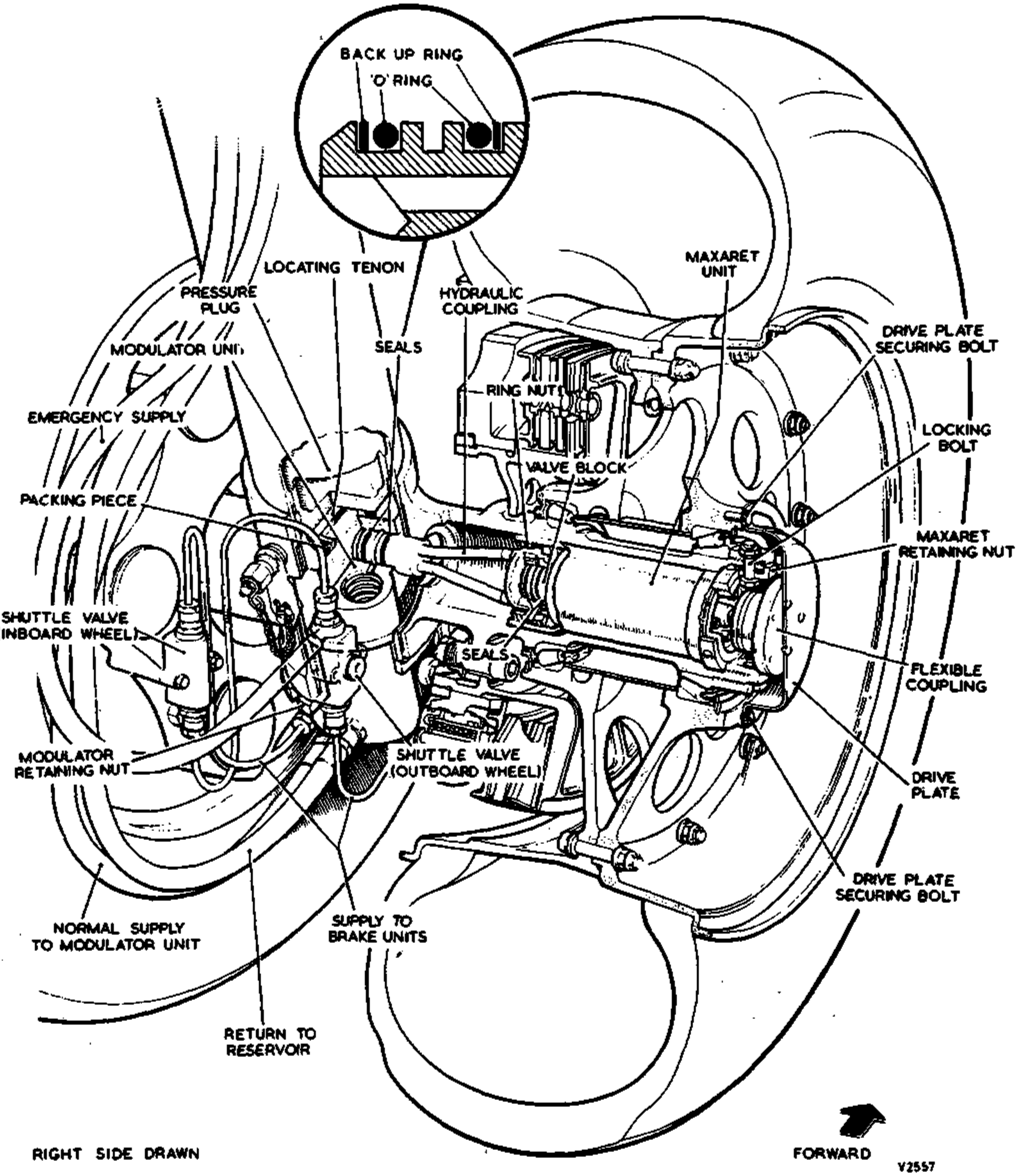
NOTE : If a single Maxaret unit only is being removed, only the supply line to the modulator unit need be removed.

(3) Remove the Maxaret and coupling assembly from one wheel :-

(a) Remove the bolts securing the drive plate to the wheel and detach the complete flexible drive assembly.
(b) Remove the locking bolt and unscrew the Maxaret retaining nut using special spanner.
(c) Extract the Maxaret and coupling assembly. If the assembly does not easily withdraw, loosen the nameplate bolts on the Maxaret unit and use the special extraction tool engaged behind the bolt heads.
(d) Remove the ring nut from the Maxaret unit, using the special spanner, and withdraw the hydraulic coupling.

(4) Repeat procedure in operation (3) for the other wheel.

...Maxaret installation - Maintenance practices continued



Maxaret and modulator units - removal and installation
Fig.201

...Maxaret installation - Maintenance practices continued

(5) Remove the connections from the modulator. Unscrew the modulator retaining nut and withdraw the modulator from the leg. Refit the connections to the modulator. Remove old grease and sealant from the threads and head respectively of the modulator retaining nut.

B. Install two Maxaret units and modulator unit (Fig.201)

NOTE : This procedure covers the installation of both Maxaret units on one leg and includes the modulator unit installation. In cases where a single Maxaret unit is to be installed when the modulator unit and the other Maxaret unit on the leg are still fitted, see para.1.C.

(1) Prepare each Maxaret unit :-

(a) Remove the blanking plug and ring nut from the valve block end of the unit.

(b) Ensure that the unit external seals are clean, then lubricate them lightly with system fluid.

(c) Locate the hydraulic coupling body over the Maxaret valve block and fit the ring nut. Tighten nut, using special spanner. Wire-lock the coupling to the ring nut.

(2) As an anti-corrosion precaution, apply grease, to the axle bores as far as possible and syringe oil over the inaccessible areas around the plunger tube.

(3) Remove the connections from the modulator. Ensure that the packing piece at the top of the modulator is serviceable and correctly located. Insert the modulator into the leg and position the locating tenon in the pressure plug. Grease threads and loosely fit modulator retaining nut.

(4) Insert the special alignment tool into one axle on the leg and manipulate both the tool and the modulator until the spigot of the tool correctly engages the coupling port in the modulator.

(5) Select the Maxaret and coupling assembly to be installed in the other axle; ensure, by reference to the arrow on the nameplate, that the direction of rotation is correct. Lightly lubricate the coupling connections with clean system fluid.

(6) CAUTION : DO NOT ROTATE THE MAXARET WHEN ENGAGING THE COUPLING WITH THE MODULATOR, AS ROTATION MAY DAMAGE THE SEALS.

Fit the Maxaret and coupling assembly to the axle, ensuring that the coupling connection correctly engages in the modulator port. Push the assembly fully home by means of the special installation tool, and fit the retaining nut.

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...Maxaret installation - Maintenance practices continued

(7) Tighten the retaining nut using the special spanner and torque load to 3-5 lb.ft. (greased) to align a locking hole in the nut with a hole in the axle.

(8) Remove the alignment tool and repeat operations (5) to (7) inclusive for the second Maxaret and coupling assembly.

(9) Tighten the modulator retaining nut, fit and wire-lock locking bolt. Fit modulator connections and connect the pipelines. Seal around head of retaining nut with fillet of thiokol.

(10) Fit wheels (if not already installed) (See Chapter 32, MAIN WHEEL). Insert locking bolt through wheel nut, axle and Maxaret retaining nut, but do not fit flexible drive assemblies at this stage.

(11) Prime and bleed the installation (see para.2.A).

C. Install single Maxaret unit (Fig.201)

NOTE : This procedure is only applicable if the modulator unit and other Maxaret unit on the leg are still installed. For installation of both Maxaret units and the modulator unit see para.1.B.

(1) Remove the blanking plug and ring nut from the valve block end of the Maxaret unit.

(2) Ensure that the unit external seals are clean, then lubricate them lightly with clean system fluid.

(3) Locate the hydraulic coupling body over the Maxaret valve block and fit the ring nut. Tighten nut, using special spanner. Wire-lock the coupling to the ring nut.

(4) Ensure, by reference to the arrow on the nameplate, that the direction of rotation of the unit is correct. Lightly lubricate the coupling connections with system fluid.

(5) As an anti-corrosion precaution, apply grease to the axle bore.

(6) Fit the Maxaret and coupling assembly to the axle, ensuring that the coupling connection correctly engages in the modulator port. Push the assembly fully home by means of the special installation tool, and fit the retaining nut.

(7) Fully tighten the retaining nut, using special spanner; as necessary, slacken the nut the minimum amount required to align a locking hole in the nut with a hole in the axle.

...Maxaret installation - Maintenance practices continued

(8) Fit wheels (if not already installed) (see Chapter 32, MAIN WHEEL). Insert locking bolt through wheel nut, axle and Maxaret retaining nut, but do not fit flexible drive assembly at this stage.

(9) Make hydraulic connections to modulator unit.

(10) Prime and bleed the installation (see para.2.A).

2. Adjustment/Test

A. Prime and bleed installation

(1) Remove the flexible drive assembly.

(2) Pressurize the main hydraulic system to above 1750 lb/sq.in. and depress the relevant brake pedal fully.

(3) Use the special hand key to rotate the Maxaret input shaft smartly in the direction indicated by the arrow, then bring it sharply to rest. Repeat the sequence several times; any trapped air will then have passed through to the reservoir.

(4) Examine the flexible drive assembly for delamination and deterioration of rubber component, security of rivets and condition of splines. Smear the splined portion of the flexible drive assembly with anti-seize compound and enter it into shaft of the Maxaret unit. Align the holes in the drive plate with the holes in the wheel and fit the bolts. Wire-lock the bolts together.

* * *

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## BRAKE UNIT - TROUBLE SHOOTING

| Fault | Cause | Rectification |
|---|---|---|
| Leakage at bleed points | Loose bleed screw, adapter or faulty seal | (1) Tighten bleed screw. (Max. torque 30 lb. in. lubricated).<br>(2) Tighten adapter (Max. torque 8 lb. ft. lubricated)<br>(3) Renew faulty seal. |
| Leakage in the vicinity of piston and cylinder liner | Faulty sealing ring(s) | Renew faulty sealing ring(s). See Dunlop Overhaul Manual DM. 1339. |
| Sluggish response to brake control operation | Air in system | Bleed the brake system. Refer to WHEELS AND BRAKES - MAINTENANCE PRACTICES. |
| External leakage from shuttle valve connections | Loose connection or faulty O-ring seals | Check tightness of connections. Torque should be 9 lb. ft. (greased). If leakage persists renew 0-ring seals. |
| Leakage past the shuttle, indicated by drop in system pressure. | Faulty shuttle sealing. | Examine the shuttle and 0-ring seals for damage. Check for the presence of foreign matter. Renew shuttle or 0-ring seals as necessary. |

* * *

# BRAKE UNIT - SERVICING

## 1. General notes on brake maintenance

**WARNING: TO OBTAIN MAXIMUM EFFICIENCY OF THE BRAKE UNITS THEY MUST BE ADEQUATELY COOLED BETWEEN APPLICATIONS AND, UNDER SOME CIRCUMSTANCES, BEFORE PARKING. REFER TO THE CREW MANUALS FOR DETAILS OF COOLING PERIODS AND THE PROCEDURE TO BE OBSERVED.**

*NOTE: In view of the varying conditions under which an airplane can be operated, it is extremely difficult to suggest maintenance instructions suitable for all operators. Two basic schemes are recommended:*

(1) Where operating conditions promote reasonably even pad wear it is suggested that maintenance is based on the replacement of stator, pressure and thrust plate assemblies when the assembly as a whole has worn to a minimum permitted thickness. This system permits the use of the pad wear gauge for 'in-situ' wear checks.

(2) Where conditions promote uneven wear or results in damage to pads, it may be advantageous to adopt an 'on condition' system based on the replacement of individual stator, pressure and thrust plate assemblies. If this system is used the pad wear gauge should not be used for 'in-situ' checks, as it will be necessary to re-new or re-pad a particular assembly as each individually reaches a minimum return to service dimension. This dimension must be obtained by adding the average amount of wear experienced between check periods to the minimum thickness quoted for the particular assembly.

## 2. Unit Servicing

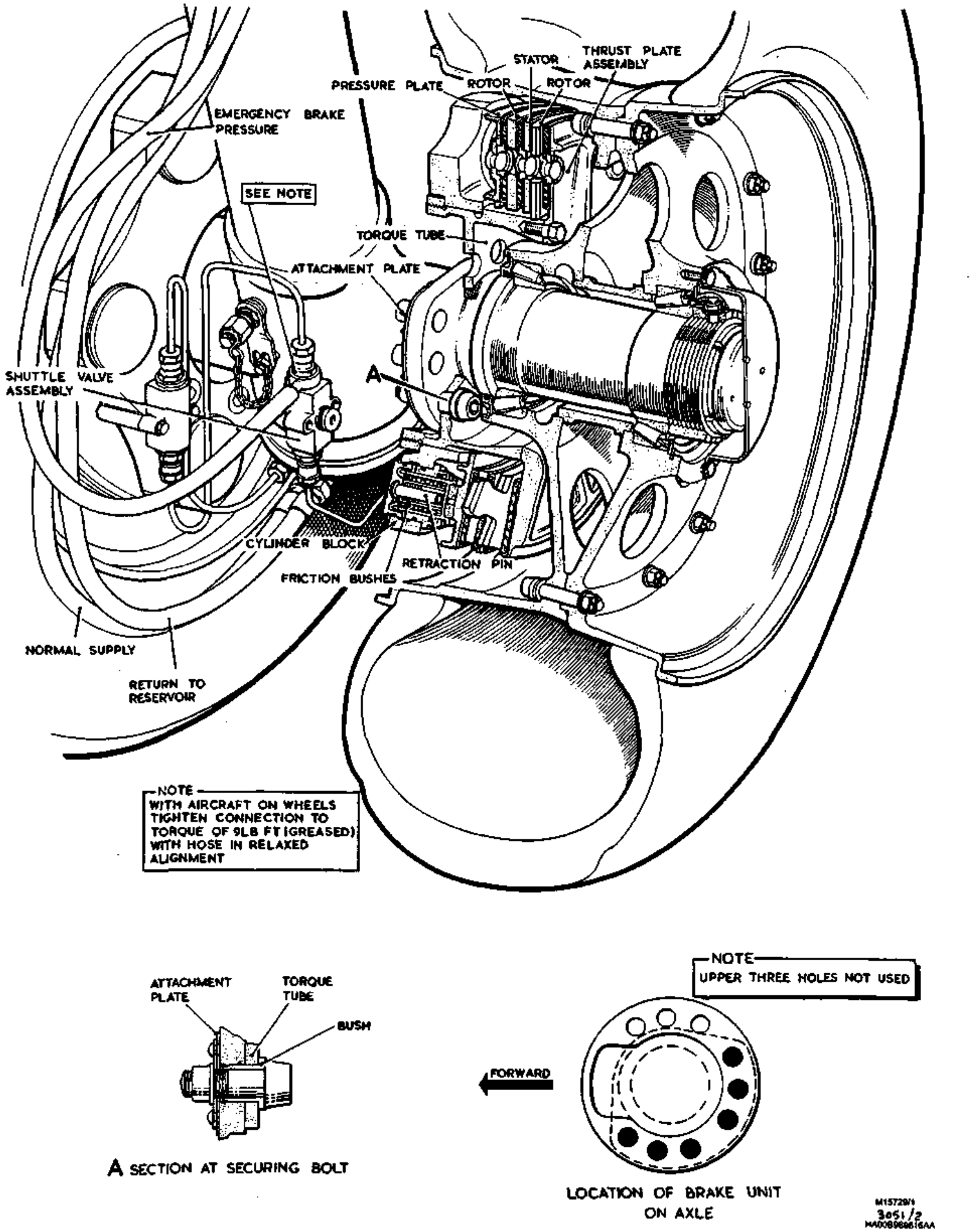
| Equipment/Material | Part/Item No. |
|---|---|
| Resetting tool (friction bushes) | Dunlop A.11921 |
| Torque wrench adapter (bleed screw) | Britool AB.344 |
| Torque wrench adapter (bleed screw adapter) | Britool EB.562 |
| Alignment fixture, brake rotors | Dunlop A.11848 |
| Torque wrench adapter (thrust plate bolts) | Britool EB.500 |
| Hydraulic fluid | 107 (Chapter 20-95-101) |
| Anti-seize grease | 002 (Chapter 20-95-11) |

### A. Partially disassemble brake for inspection

**CAUTION: ATTACH WARNING NOTICES TO THE CAPTAIN'S AND FIRST OFFICER'S BRAKE CONTROLS INDICATING THAT THE BRAKES MUST NOT BE USED.**

(1) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(2) Remove the wheel (MAIN WHEELS).



Brake unit assembly
Figure 301

(3) Release the brakes from the parking position.

**CAUTION: BEFORE REMOVING ASSEMBLY OF STATORS AND ROTORS IDENTIFY STATORS AND ROTORS TO MAKE SURE THAT, WHERE PRACTICABLE, THEY CAN BE REASSEMBLED IN THEIR ORIGINAL RELATIONSHIP.**

(4) Remove the bolts which secure the thrust plate assembly and remove the assembly.

(5) Ascertain which method of rotor inspection is intended (Rotor Assembly Inspection - INSPECTION/CHECK) and remove the assembly of stators and rotors. Make sure that, if method 1 is to be carried out the rotors are retained as assemblies. This may be accomplished by the use of suitable ring clamps for free assemblies or by not freeing off assemblies which are self retained by distortion.

(6) Remove the stator, rotor and pressure plate assemblies.

**B. Assemble brake unit on completion of inspection procedure** *(Figure 301)*

(1) If inspection (INSPECTION/CHECK) proves the brake units to be serviceable, reassemble each unit as detailed in paragraphs (2) to (4) following. If any new or repaired stator, rotor, pressure or thrust plate assemblies are to be installed during reassembly, reset the friction bushes as follows:

(a) Install the resetting tool to the axle.

(b) Open the bleed screws.

(c) Rotate the resetting tool handle to push the pistons fully home into the cylinder liners. Close the bleed screws and remove the resetting tool.

(d) Lubricate the bleed screw threads with hydraulic fluid (Item 107) and torque tighten to 30 lbf.in. (3.4 Nm) and wirelock. Remove the resetting tool.

(2) Install the stator and rotor assembly to the torque tube making sure that the heavier rotor is adjacent to the pressure plate. Where practicable stator friction surfaces should be in contact with their original rotor friction surfaces.

(3) Install the thrust plate assembly. Lubricate the securing bolt threads with anti-seize grease (Item 002). Install the bolts, tighten to a torque of 15 lb.ft. and wirelock each bolt separately to the adjacent hole in the circumferential web. The free ends of the lockwire must be located at the hole in the web, as short as practicable, and bent back against the web.

(4) If the friction bushes have been reset, locate brake rotors concentrically and in correct alignment about the brake torque tube, using the special alignment fixture and bleed the brakes (WHEELS AND BRAKES). Operate the brake several times and check that the rotors are free when the brake is released and resist movement when the brake is applied.

*NOTE: If the rotors fail to release after the friction bushes have been reset as detailed in paragraph (1) preceding, the complete resetting and load checking procedure detailed in the Dunlop Overhaul Manual DM 1339 will have to be effected.*

(5) Install wheels (MAIN WHEELS).

(6) Lower the airplane to the ground and remove the jacks (Chapter 7, JACKING AND TRESTLING).

**C. Close up**

(1) Make sure that the work area is clean and clear of tools and miscellaneous equipment.

# BRAKE UNIT - REMOVAL/INSTALLATION

## 1. Removal/Installation *(Figure 401)*

**CAUTION: ATTACH WARNING NOTICES TO THE CAPTAIN'S AND FIRST OFFICER'S BRAKE CONTROLS TO PREVENT OPERATION OF THE BRAKES.**

**CAUTION: TAKE PRECAUTIONS TO PREVENT CONTAMINATION OF THE BRAKE UNIT BY OIL, FLUIDS AND GREASES.**

### A. Remove Brake Unit

(1) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(2) Remove the wheel (MAIN WHEELS).

(3) Release the brake pressure (Chapter 29, HYDRAULIC POWER).

(4) Make provision for collecting spilled fluid and blanking off pipelines and connections. Prevent the friction faces against fluid contamination.

(5) Disconnect all pipelines to the shuttle valve assembly and remove the shuttle valve. Suitably blank all pipelines and valve apertures.

(6) Remove the securing bolts and remove the brake unit and attachment plate.

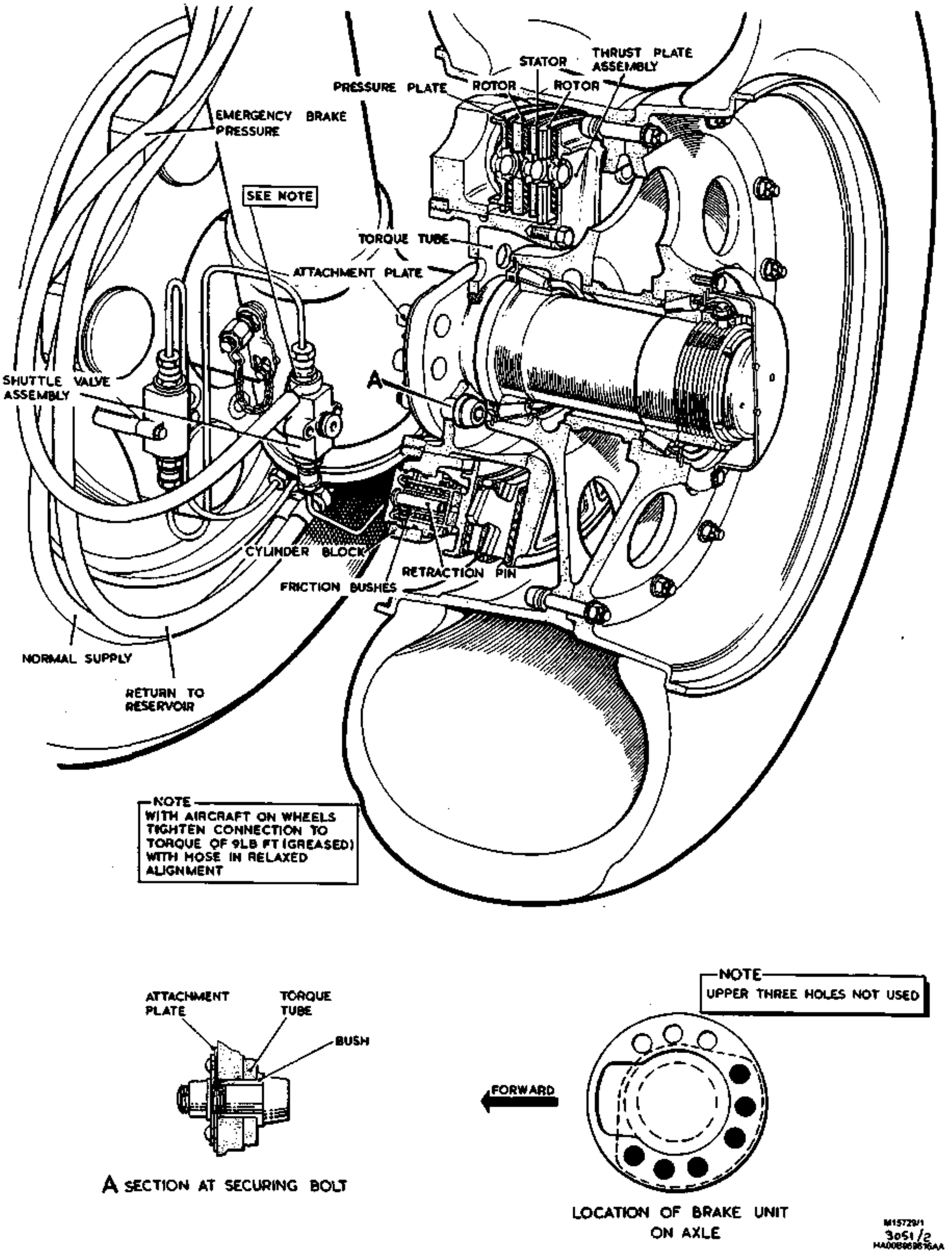
### B. Install Brake Unit

| Equipment/Materials | Part/Item No. |
|---|---|
| Torque wrench | 5 lb.ft. |
| Torque wrench | 30 lb.in. |
| Anti-seize compound | 002 (Chapter 20-95-11) |
| Hydraulic fluid | 107 (Chapter 20-95-101) |

(1) Install the bushes to the appropriate mounting holes in the torque tube with the flanges positioned as shown in *Figure 401*.

(2) Put the brake unit onto the axle assembly and make sure the bushes are located in the mounting holes in the axle assembly. Put the attachment plate in position behind the axle mounting, insert and tighten the securing bolts.

(3) Lightly lubricate the threads of the shuttle valve securing bolts with anti-seize compound (Item 002) and install shuttle valve; make sure that the valve on the outboard brake is installed with the emergency supply hose banjo connection uppermost; tighten bolts to a torque load of 5 lb.ft. and wirelock. Connect all pipes to shuttle valve and lock connections.



NOTE
WITH AIRCRAFT ON WHEELS TIGHTEN CONNECTION TO TORQUE OF 9LB FT (GREASED) WITH HOSE IN RELAXED ALIGNMENT

NOTE
UPPER THREE HOLES NOT USED

A SECTION AT SECURING BOLT

LOCATION OF BRAKE UNIT ON AXLE

Brake unit - removal / installation
Figure 401

(4) Locate the brake rotors concentrically and in correct alignment around the brake torque tube using the special alignment fixture then prime and bleed the brake unit (WHEELS AND BRAKES). Tighten the bleed screws to a torque of 30 lb.in. and wirelock the screws.

(5) Do a test of the Maxaret unit (MAXARET INSTALLATION).

(6) Install the wheel (MAIN WHEELS).

(7) Lower the airplane to the ground and remove the jacks (Chapter 7, JACKING AND TRESTLING).

### C. Close up

(1) Make sure that the work area is clean and clear of tools and miscellaneous equipment.

# BRAKE UNIT - INSPECTION/CHECK

## 1. Cylinder block and torque tube inspection

### A. Procedure

| Equipment/Material | Part/Item No. |
|---|---|
| Tenon wear gauge | Dunlop A0.101795 |
| Rotor shrinkage gauge | Dunlop A.12161 |

(1) Inspect for signs of leaks near the cylinder liners and pistons, indicating faulty sealing.

**CAUTION: WHEN BLENDING OUT SHARP EDGES IT IS ESSENTIAL TO PRESERVE THE ANGULAR RELATIONSHIP OF THE TENON FACES AND TO AVOID FURTHER DECREASE IN OVERALL WIDTH.**

(2) Inspect the cylinder block for damage and corrosion. Superficial cuts and abrasions, and slight surface corrosion may be dressed out with a smooth file or emery cloth Restore protective treatment after dressing (Chapter 20, DUNLOP STANDARD PRACTICES).

(3) Make sure that the torque tube is securely attached to the cylinder block.

(4) Inspect the tenons for wear. The minimum permitted tenon width is 0.560 in. If a tenon is unserviceable the tube must be withdrawn from service. Where a tenon is worn but still within limits, blend out any sharp edges with a smooth file.

## 2. Stator, pressure and thrust plate inspection

### A. Procedure

*NOTE: Refer to the Dunlop Overhaul Manual DM 1339 for details of pad renewal procedure.*

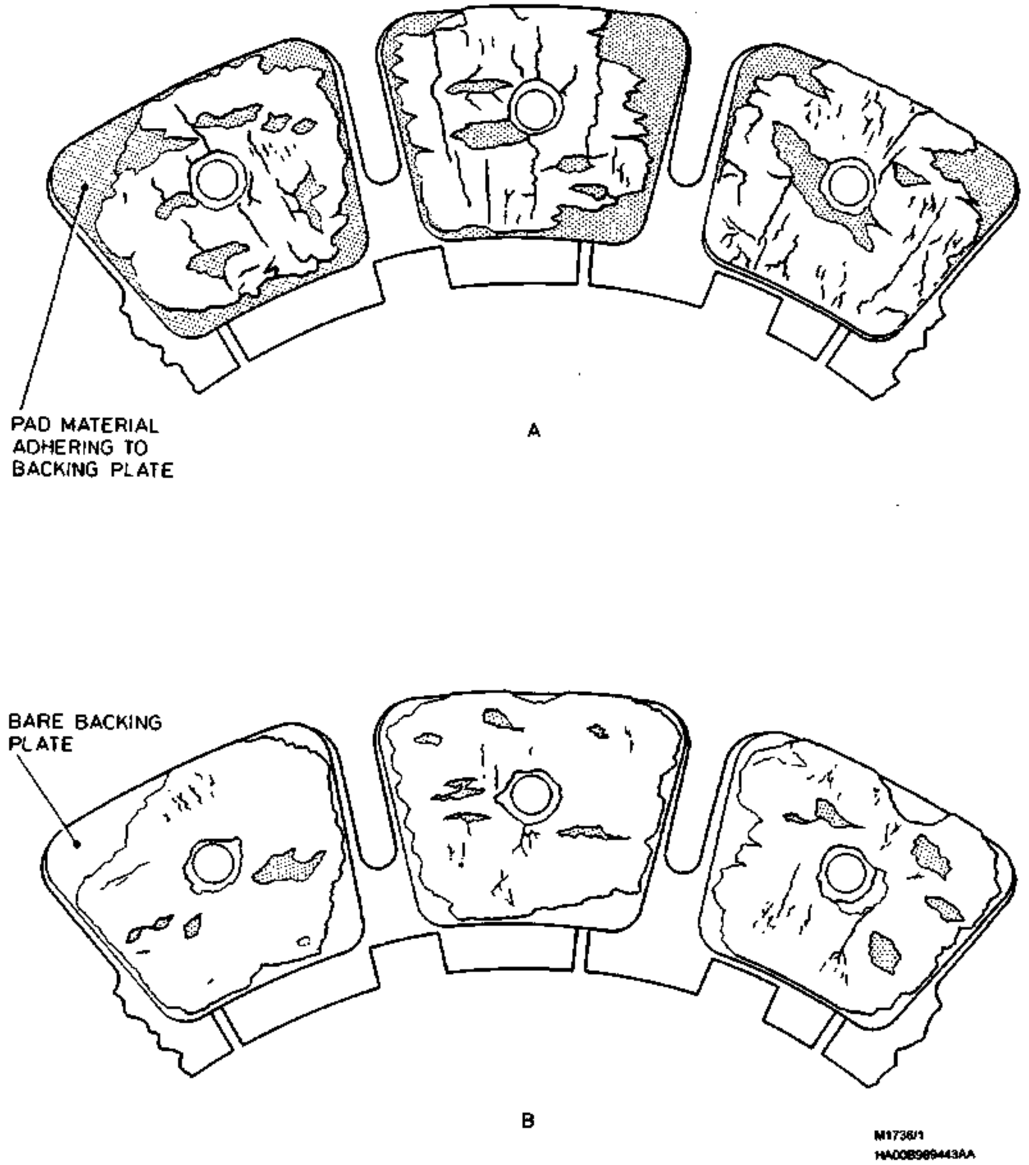
*NOTE: Refer to Tables 601 and 602 in paragraphs (8) and (9) for numerical values of the letters quoted in the following paragraphs.*

(1) Check the thickness of the brake pads irrespective of an in-situ check having indicated remaining wear. Measure at several points the combined thickness of the pads and stator plate, the pads and thrust plate and the pads and pressure plate (measure to the central boss of the pressure plate). Reject sub assemblies worn to the limit defined in the following paragraphs.

*NOTE: Dimensions A, B and C for the relevant sub assemblies are reject thicknesses beyond which the sub assemblies must not remain in use. To obtain suitable 'return to service' dimensions operators should add to A, B or C the amount of thickness reduction normally experienced between checks. An allowance for an emergency stop should NOT be made as sufficient pad material remains at the reject thicknesses to cater for such a contingency.*

(2) Examine the brake pads for surface deterioration.

NOTE: *With the progress of wear, deterioration of varying intensity may be observed on the friction faces of the pads and a degree of judgement must be used in determining serviceability. A condition known as 'crazing' initially occurs and this may subsequently advance to the state of surface cracking shown in Figure 601. This condition, also chipping and flaking of the pad are not detrimental and may be disregarded. Surface deterioration in the form of lining material 'breakaway' as shown in Figure 601 is permissible providing it conforms with the following limits and conditions. It is emphasized that there will be no significant loss of braking performance if the stators, pressure or thrust plates are retained in service up to the limit of deterioration permitted by the following limits and conditions.*



Serviceable Brake Pads
*Figure 601*

(a) Renew any pad which has the full depth of lining material missing, that is, exposing the base of the pad casing in any area

(b) Renew any pad which has more than 40% of its surface affected by material 'breakaway'. Substantial 'breakaway' below 40% must be dispersed over two or more areas. No single area must exceed 20% of the surface.

(c) Renew any pad which has a fractured casing.

(d) Renew all the pads on any stator, pressure or thrust plate where three or more adjacent pads on the same face have the full depth of lining material missing from 50% or their areas.

(e) Renew all the pads on any stator, pressure or thrust plate where two or more adjacent pads on the same face have no lining material remaining.

(3) Check the brake pads for security of attachment.

*NOTE: Limited looseness is permitted providing the pad does not rock and that the projections on the back of the pad are not disengaged from the holes in the associated plate.*

(4) Check the width of the stator plate tenon slots and bore clearances.

*NOTE: Slot width must not be less than X in. Bore clearance must not be less than T in. when measured between slots, or U in. when measured from the center to the base of the slots. Refer to the Dunlop Overhaul Manual DM 1339 for stator plate reclaim procedure.*

*NOTE: After a period of shrinkage, wear is likely to occur. Using the tenon slot wear gauge, check that the slot width does not exceed Y in. if wear is on one face only. If stator plates are reversed during their service life equalize wear on both slot faces, the maximum permitted stator slot width may be increased to Z in.*

*NOTE: The dimensions for the stator plate tenon slot and bore clearances detailed in paragraph (4) above apply equally to the pressure plate.*

(5) Make sure that the stator plate outer diameter does not exceed W in. If this dimension is exceeded, refer to the Dunlop Overhaul Manual DM 1339 for reclaim procedure.

(6) Check stator plate for cracks. Refer to Dunlop Overhaul Manual DM 1339 for reclaim procedure.

**CAUTION: DO NOT FILE OR DRESS THE ABUTMENT FACES.**

(7) Check the side faces of the tenon slots for burrs. Carefully remove any burrs with a smooth file.

(8) Wear limits - stator, pressure and thrust plate assemblies.

*Table 601*

| Brake unit Part No. | 1/4 worn (in.) | 1/2 worn (in.) | fully worn (in.) | Stator and pads. A (in.) | Pressure plate and pads B (in.) | Thrust plate and pads C (in.) |
|---|---|---|---|---|---|---|
| AH.52430 | 1.508 | 1.577 | 1.715 | 0.310 | 0.230 | 0.194 |

(9) Dimensions for stator and pressure plates.

*Table 602*

| | Minimum service diameter | | Tenon slot widths | | | Stator plate | Pressure and Thrust plate |
|---|---|---|---|---|---|---|---|
| Brake unit Part No. | Stator bore T (in.) | Tenon slot U (in.) | Nominal X (in.) | Intermediate Y (in.) | Maximum Z (in.) | Overall dia. W (in.) | Limit of Dishing E (in.) |
| AH.52430 | 5.436 | 3.030 | 0.656 | 0.681 | 0.687 | 10.468 | 0.030 |

(10) Examine the pressure and thrust plates for damage, distortion and corrosion. Dishing in excess of E in. is not permitted. Distorted plates may be reclaimed and limited corrosion of pressure plates may be rectified as detailed in Dunlop Overhaul Manual DM1339.

(11) Examine the thrust plate retaining bolts for damage and condition of threads.

## 3. Rotor assembly inspection

### A. Procedure

Rotors may be inspected as assemblies or individual segments as defined in Methods 1 and 2. Operators should choose the method most suited to their operating conditions and experience. The inspection procedure is applicable to both methods.

Method 1.Segments are retained as assemblies and remain in their original relationship throughout their complete service life. These segments may distort and become tight after a period of service. This condition is normal and should be disregarded. If a segment is unserviceable the complete assembly must be broken down and segments inspected as in Method 2 for the remaining service life.

Method 2.Segments are not retained as assemblies but are separated for individual inspection.

*NOTE: Refer to Tables 603 and 604 in paragraph (9) for numerical values of the letters quoted in the following paragraphs.*

(1) Remove any adhering pad material by any suitable means.

(2) Weigh each rotor assembly and reject any assembly if its weight is not more than E lb. To obtain a suitable 'return to service' weight, add to E the amount of weight loss normally experienced between checks. Mark each assembly with its weight to assist selection of a brake set of rotors.

(3) Check that the width of any tenon is not less than H in. Renew defective segments. Do not file or dress abutment faces.

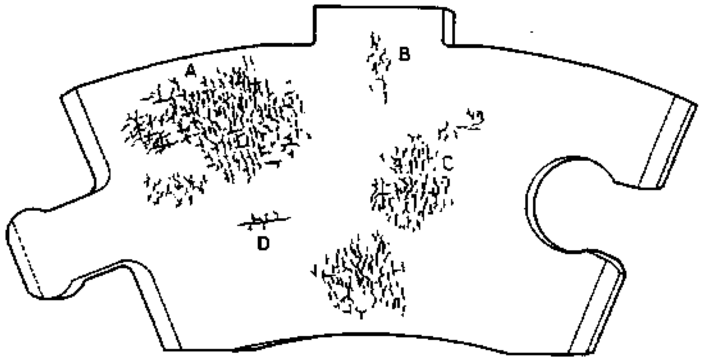


PLATE 1

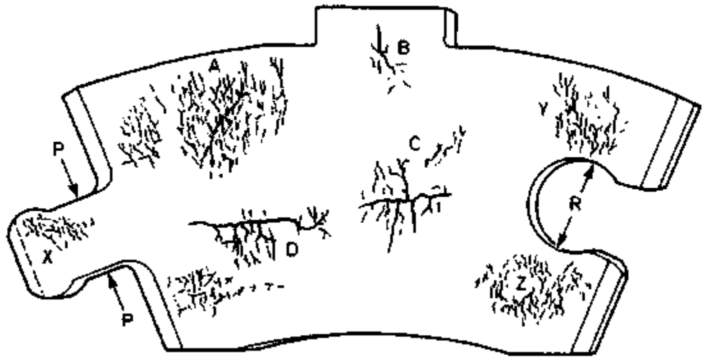


PLATE 2

Cracks in rotor segments
*Figure 602*

(4) Check for excessive waisting. Assessment of condition must be based on service experience. Waisting is a normal wear condition which has little detrimental effect, unless rotors are used in a rebuilt brake, when a period of increased wear will be encountered until pads and rotors are fully mated.

(5) Visually examine the friction faces of each segment for cracks. Pay particular attention to the corners of the tenon slots, the root of the tongue and the areas surrounding the tongue slot. Two types of defect may be found, the second sometimes being a development of the first.

(a) Refer to plate 1 of *Figure 602*. This shows deterioration in the form of a series of very fine surface cracks similar to glazing cracks in pottery. Comparatively extensive surface cracking of this nature is permissible in the central area of the segment and some degree of judgement must be used in assessing the condition. A segment with a total area of surface cracking similar to that shown on plate 1 may be regarded as serviceable but any extension beyond this, particularly to the areas above and below the tongue slot may warrant rejection of the segment. Remove any segment from an assembly if surface cracking extends to the edge of the tongue slot or tongue. Such cracks are permitted provided they are less than 0.03 in. when viewed from directions P and R. Cracks on the tongues may be arrested, if desired, by removing 0.015 in. from each side of the tongue as detailed in the Dunlop Overhaul Manual DM 1339. The datum for measurement of cracks on tongues of reduced thickness is the segment friction surface.

(b) Refer to plate 2 of *Figure 602*. This illustrates the development of fine surface cracks on the tongue and above and below the tongue slot and how the minute surface cracks shown on plate 1 may eventually join to form major cracks. Any one of the major cracks shown or major cracking of any kind on the tongues above and below the tongue slot would render the segment unserviceable.

(c) Cracks similar to those shown on plate 2, irrespective of whether they have developed from minor surface cracks, or whether they are isolated must be judged in accordance with the following principles.

(d) Cracks up to 3/8 in. long may be permitted in the central area providing they show no tendency to join and form major cracks and providing they cover only a limited area of the segment.

(e) Short cracks, similar in magnitude to those illustrated on plate 2 but less than 3/8 in. long still render the segment unserviceable if within 3/8 in. of a segment edge or slot.

Examples - the major cracks shown at A, C and D, because of their length, render the segment unserviceable. The crack shown at B, although short, render the segment unserviceable because it is within 3/8 in. of the segment edge. The fine surface cracks at X, Y and Z are permissible provided they do not exceed 0.030 in. depth when viewed from directions P and R. The cracked tongue should be machined as detailed in the Dunlop Overhaul Manual DM 1339.

(6) Reassemble segments which have been separated. If reclaimed or part worn serviceable segments, are substituted for unserviceable segments, or if segments have been mixed and cannot be identified with their original rotor assembly, check that the thickness variation throughout the assembly does not exceed H in. For this check, measure at the mating edges of segments and avoid any waisted areas. Repeat the weight check detailed in paragraph 2. Suitably identify the segments to make sure that they are retained as an assembly for the remainder of the inspection.

*NOTE: Segments returned to the manufacturer for reclaim will be reground to fixed dimensions and can be identified by 1/16 in. grooves on the outer edge. Each groove indicates a stage of reclaim.*

*NOTE: When assembling part worn segments into rings, difficulty may be experienced in mating tongues and slots. To facilitate assembly, dressing of slots is permitted as detailed in the Dunlop Overhaul Manual DM 1339.*

(7) Check each rotor assembly for shrinkage as follows. Place the assembly in the shrinkage gauge and select one segment for check. Push the selected segment and those at 90 and 180 degrees in the directions indicated by arrows on *Figure 603* using light hand pressure. Check the tenon engagement and bore clearances of the selected segment. The pin provided must not enter between the outer edge of the tenon and the shrinkage gauge and bore clearance must not be less than J in. Reject the segment if the pin enters. Bore clearance may be restored by dressing the inner edge of the segment. Repeat this check on all segments in turn.

(8) Check that the weight of the complete brake set of rotors is not less than G lb. To obtain a suitable 'return to service' weight, add G to the amount of weight loss normally experienced between checks. Selective assembly of rotors from spare sets will achieve this condition.

(9) Weights and dimensions for rotor assemblies.

*Table 603*

| Brake unit part No. | Aircraft Series | Reject weight Single Rotors F lb. | Reject Weight Set of Rotors G lb. | Minimum Tenon Width H in. |
|---|---|---|---|---|
| AH.52430 | 400A | 4.40* | 9.0 | 0.965 |
| | 400B | 4.40* | 9.0 | 0.965 |
| * Weight new = approx 4.675 lb. | | | | |

*Table 604*

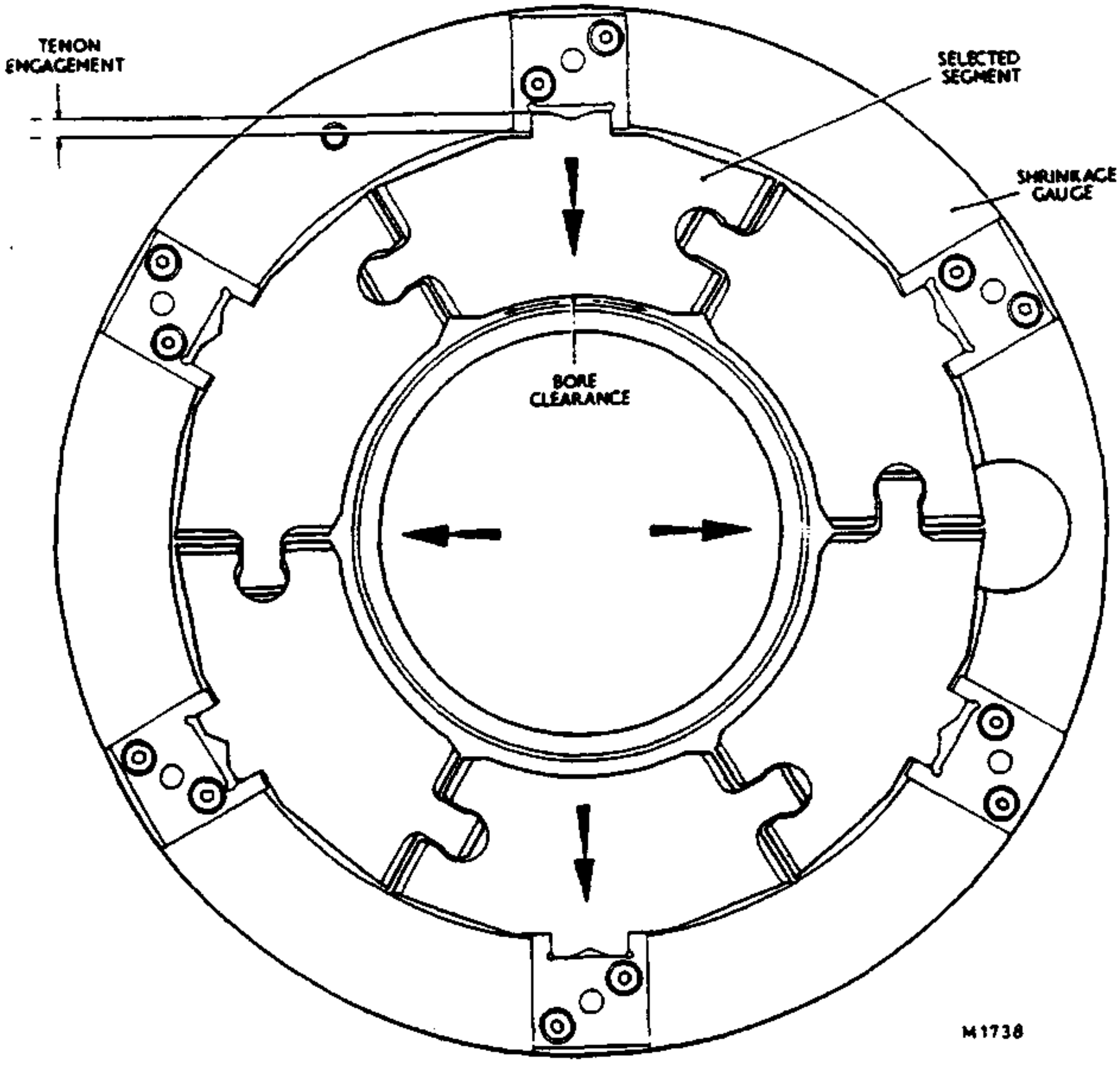
| Brake unit part No. | Maximum Thickness Variation. J in. | Shrinkage Gauge Clearance. K in. |
|---|---|---|
| AH.52430 | 0.008 | 0.062 |

## 4. Action after an emergency stop *(Figure 604)*

**WARNING: EXERCISE CAUTION WHEN APPROACHING WHEELS AFTER AN EMERGENCY STOP AND ALLOW AN ADEQUATE COOLING PERIOD TO ELAPSE BEFORE ATTEMPTING ANY REMOVAL OF WHEELS OR BRAKE UNITS.**

| Equipment/Material | Part/Item No. |
|---|---|
| Pad Wear Gauge (for in-situ wear check - slush guards not installed). | Dunlop AO.109553 |
| Pad Wear Gauge (for in-situ wear check - slush guards installed or not installed). | Dunlop AO.115986 |

*NOTE: After an emergency stop has been reported by the pilot, let the brakes cool, raise each wheel in turn, and examine each wheel/brake combination in the following sequence.*



Rotor shrinkage gauge
*Figure 603*

### A. Brakes

(1) Release the brake and check that the wheel can be freely rotated.

(2) Remove the wheel.

(3) Pressurize the brakes and do a check for leaks at the brake units and flexible pipes.

(4) Partially disassemble brake unit (SERVICING) and inspect the brake unit as detailed paragraphs 1.A, 2.A and 3.A.

(5) If brake unit are serviceable, re-assemble as detailed in unit servicing.

### B. Wheel

(1) Visually examine each wheel for signs of excessive heat or flange deformation. Renew any wheel that shows such damage.

(2) Remove any wheel with a blown fusible plug and do the examinations detailed in paragraphs (3) and (4).

(3) Aluminum alloy wheels - Do a check of the hardness of the brake side hub material at four equally spaced points around the outer end face of the hub center. One point must be in the area considered to have been the hottest as indicated by point discoloration. If the hardness at any point is less than Brinell 125 (or equivalent) reject the half hub and repeat this inspection on the other half hub.

*NOTE: If the hub center is inaccessible using the equipment available, apply the checks to the end face of the flange.*

(4) Examine the wheel in accordance with the Inspection instructions in the Dunlop Overhaul Manual DM. 1339. Make sure that the checks for distortion are done.

### C. Tires

(1) Replace a tire on a wheel with a blown fusible plug. The tire on the adjacent wheel will have been overstressed and must be removed for examination. Refer to the Dunlop Overhaul Manual DM. 1339.

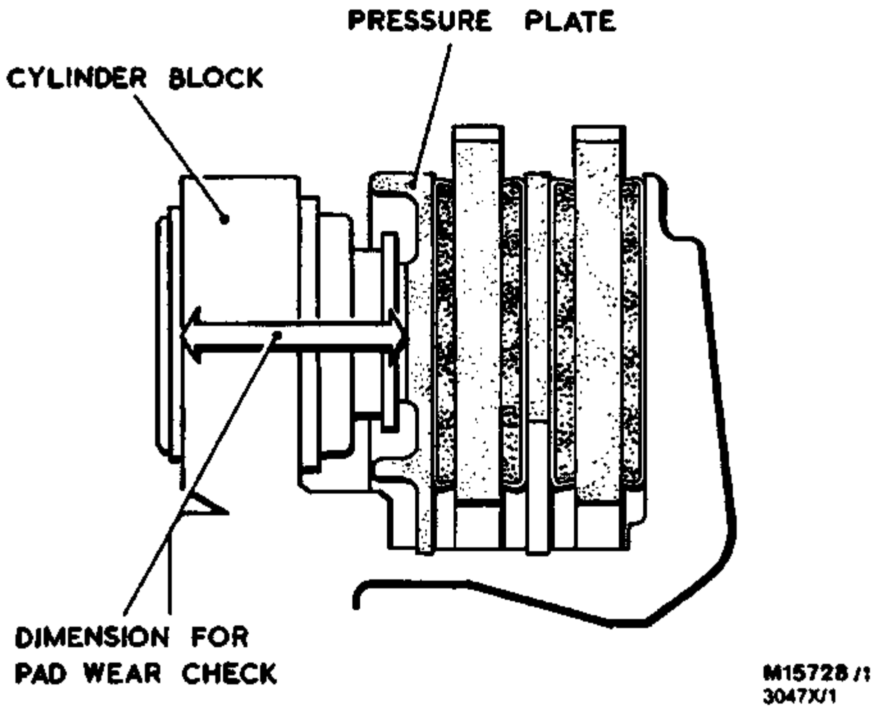
  (a) Examine the tire for signs of overheating, that is, blistering, chafing, melting or incipient bead failure indicated by irregularities in the moulding lines near the wheel flange. Renew any tire that shows such damage.

## 5. Pad wear check

Pressurize the brake and do a check on the progress of pad wear with the pad wear gauge. The measurement is taken from the front face of the cylinder block. Check the dimensions are as shown on *Figure 604.*

*NOTE: When the brake unit is protected by a slush guard a special pad wear gauge will be required, Part No. AO.115986. The associated pad wear dimensions are shown in brackets in Figure 604, the measurement being from the outer face of the slush guard.*

| Pad wear dimensions<br>(Brake assembled) | | |
|---|---|---|
| 1/4 worn (in.) | 1/2 worn (in.) | fully worn (in.) |
| 1.508<br>(1.544) | 1.577<br>(1.613) | 1.715<br>(1.751) |



Pad wear check
*Figure 604*

## EMERGENCY REDUCING VALVE - TROUBLE SHOOTING

| Fault | Possible cause | Rectification |
|---|---|---|
| Leakage from the joint faces. | Looseness of attachment screws or a faulty joint face sealing ring. | Tighten loose screws but not excessively. If the leak persists after tightening, renew the faulty sealing ring. See Dunlop Overhaul Manual DM.1339. |
| Leakage from the adjusting screw threads. | Faulty sealing ring. | Renew the sealing ring. See Dunlop Overhaul Manual DM.1339. |
| Loss of system pressure due to internal leakage. | Internal leakage. To verify, disconnect the exhaust connection, apply maximum supply pressure and check for a continuous seepage from the exhaust connection. Apply the handbrake to full park position and check for fluid seepage from the exhaust. Fluid seepage during either check verifies internal leakage. | Remove the unit from the aircraft for further investigation and rectification at overhaul base. |

* * *

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# STEERING - DESCRIPTION AND OPERATION

## 1. Description *(Figure 1)*

### General

The nose gear is steerable from a handwheel on the pilot's left side console. Movement of the handwheel is transmitted to the selector valve of a hydraulic jack at the nose gear leg. In response to a selection, the jack body moves to rotate the lower part of the leg via a steering sleeve and the leg torque link assembly. The steering range is 45 degrees in each direction.

The steering system can be disconnected, for towing, by removing a pin which normally connects the steering sleeve and torque link sleeve.

A steering on/off valve, operated by the nose gear retraction mechanism, makes sure that there is a hydraulic supply to the steering jack only when the leg is in the fully locked down position. The steering jack mechanism is protected by a small in-line filter in the hydraulic pressure supply to the jack. A relief valve installed in the jack return line (Mod.252227) makes sure that back pressure to the jack reduces the possibility of nosewheel shimmy.

### Controls

A sprocket mounted in the handwheel housing is rotated by the handwheel through a bevel gear wheel and pinion. The sprocket drives, through a small endless chain, a double sprocket assembly secured to a shaft below the handwheel housing and also secured to the shaft is a double stop with two adjustable stop bolts. Attached to a short length of chain on the double sprocket, are cables which pass over pulleys to a cable drum on the aft face of the nose gear bay rear wall. The shaft of the cable drum extends into the nose gear bay.

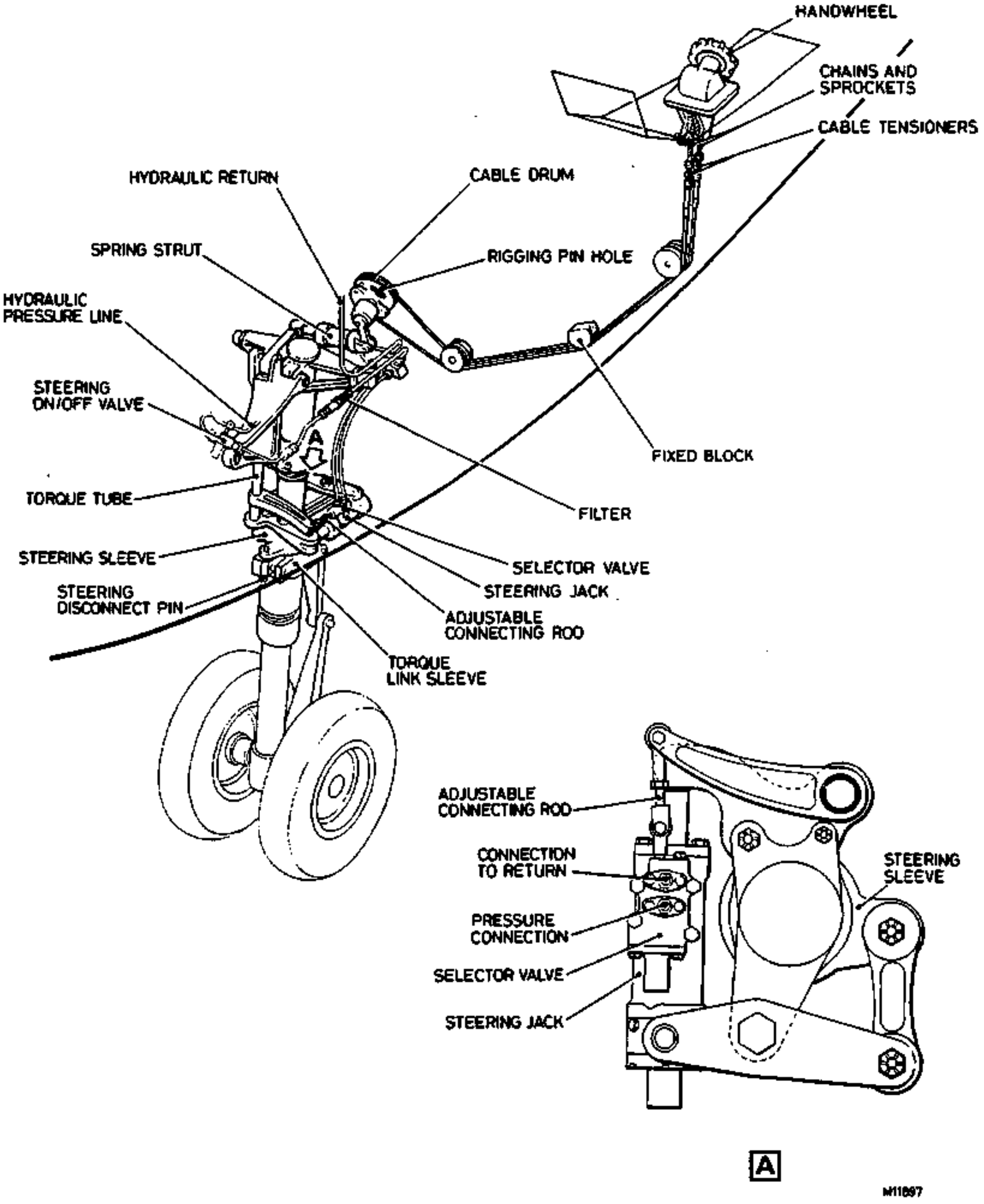
In the nose gear bay, the cable drum shaft is connected by a lever and spring strut to a lever attached to a torque tube mounted on the leg casing. A lever at the lower end of the torque tube operates, through a short connecting rod, the selector of the steering jack.

The ram of the steering jack is secured to a bracket on the leg casing. The jack body is attached to a pair of levers which are connected by a link to the steering sleeve around the leg casing. The torque link sleeve, which carries the upper torque link connection, is connected to the steering sleeve by the steering disconnect pin.

## 2. Operation

Rotation of the handwheel away from the central position is transmitted by the control system to give a corresponding selection on the steering jack selector valve. Main hydraulic system pressure is then effective on the appropriate side of the jack ram. Because the ram end is fixed, the jack moves to rotate the steering sleeve and hence the axle and nose wheels. Movement of the jack body also moves the selector body, bringing the selector valve to a neutral position as soon as the selected position has been reached.

The steering on/off valve is connected by a short connecting rod to the nose gear mechanical and position indicator operating fork (MECHANICAL INDICATING SYSTEM). Operation of this fork, during unlocking of the leg from the down position, will close the valve and cutoff the hydraulic pressure supply to the steering jack, so preventing any selection being made once landing gear retraction has commenced.



Nosewheel steering system
*Figure 1*

# STEERING - ADJUSTMENT/TEST

**WARNING: GROUND LOCKING PINS MUST BE INSTALLED WHEN THE MAIN AND NOSE LANDING GEAR ARE IN THE DOWN AND LOCKED POSITION.**

**WARNING: BEFORE YOU DISMANTLE ANY PART OF THE LANDING GEAR HYDRAULIC SYSTEM MAKE SURE THAT ALL HYDRAULIC PRESSURE IS RELEASED (CHAPTER 29, HYDRAULIC POWER).**

**CAUTION: BEFORE YOU RETRACT THE LANDING GEAR, MAKE SURE THE GEAR BAYS ARE FREE FROM LOOSE ARTICLES AND THE GEAR RETRACTION PATH IS FREE FROM OBSTRUCTION.**

**CAUTION: HYDRAULIC FLUID DRAINED OR BLED FROM THE HYDRAULIC SYSTEM IS TO BE DISCARDED. USE ONLY NEW HYDRAULIC FLUID TO REPLENISH THE SYSTEM OR GROUND TEST RIGS.**

## 1. Unit servicing

### A. Lubrication

For routine lubrication data refer to the Maintenance Schedule.

## 2. Adjustment/Test

| Equipment/Material | Part/Item No. |
|---|---|
| Rigging pin set | 381A or 493A |
| Cable tensiometer suitable for 10 cwt cable | Local supply |

### A. Preparation

(1) Make sure the ground locking pins are installed (Chapter 10, PARKING AND MOORING).

(2) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(3) Remove the fairing from the left side console.

(4) Remove the center floor panel in the flight compartment.

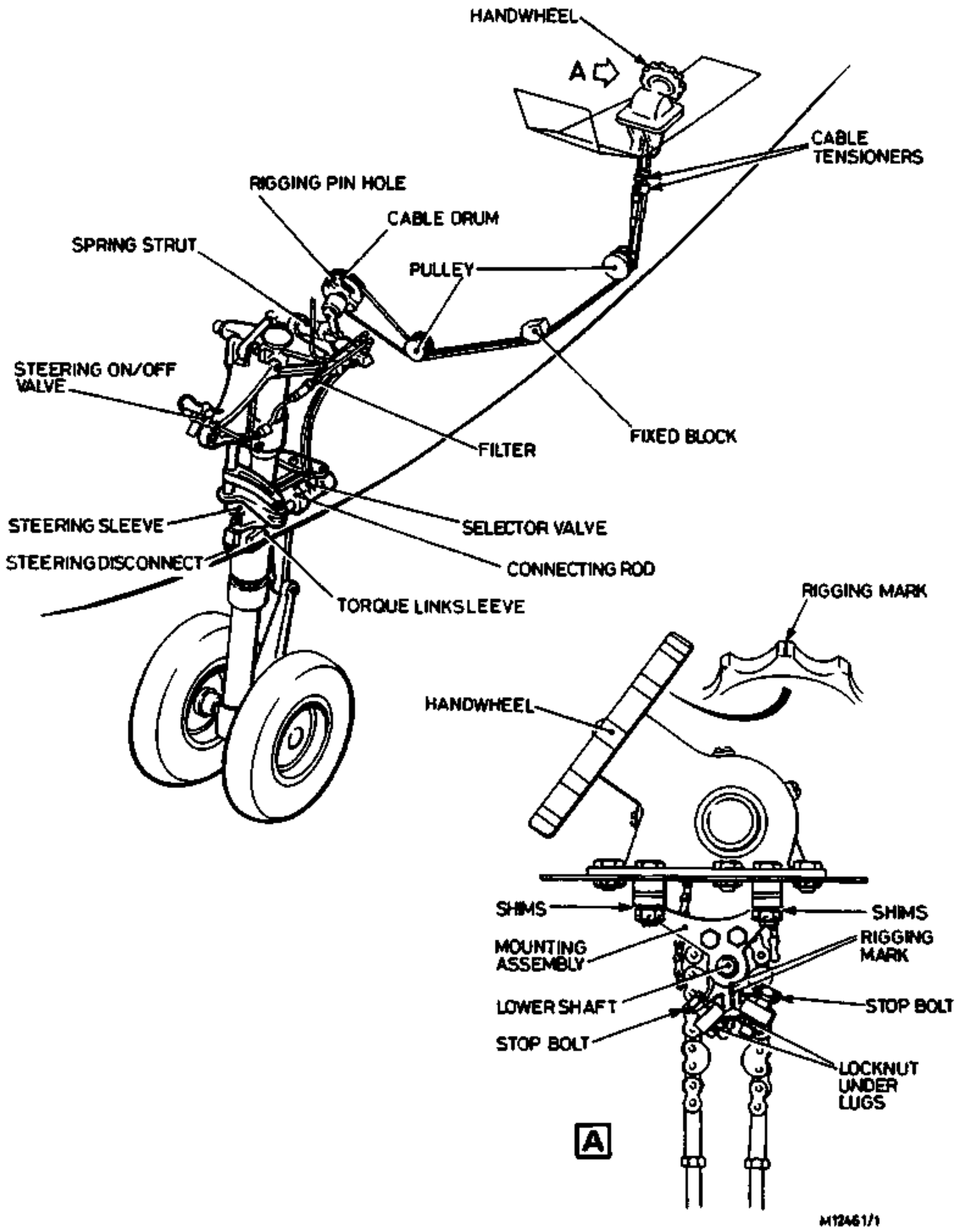
(5) Connect a hydraulic test rig to the airplane (Chapter 29, MAIN SYSTEM).

### B. Steering system adjustment *(Figure 501)*

(1) Do the preparation (para. A).

(2) Install a rigging pin in the cable drum on the aft face of the nose gear bay rear wall.

(3) Do a check of the rigging marks on the handwheel assembly: with the white mark on the handwheel at the top dead center position, make sure that the mark on the lower shaft stop aligns with the mark on the inboard shaft mounting.



Nose wheel steering adjustments

*Figure 501*

(4) Make sure the tension of the endless chain appears normal.

*NOTE: The chain tension is set on installation by adjustment of the shims between the lower shaft mounting assemblies and the spacer blocks. Equal shim thickness is required at each of the four securing bolts.*

(5) Keep the handwheel in the center position, as in paragraph (3), make sure that the larger chain is equally positioned about its sprocket.

(6) Put the tensiometer in position midway along the longest cable run between the pulley and fixed block. Adjust the cable tension to 20 lb.

(7) At the nose leg, remove the nose wheel steering disconnect pin.

**WARNING: TAKE CARE WHEN YOU RELEASE PRESSURIZED NITROGEN FROM THE LEG**

- **PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING**
- **RELEASE THE PRESSURE SLOWLY**
- **A SUDDEN RELEASE OF PRESSURE IS DANGEROUS AND CAN CAUSE INJURY.**

**CAUTION: FAILURE TO RELEASE THE PRESSURE SLOWLY MAY RESULT IN DAMAGE TO THE SHOCK ABSORBER STRUT INTERNAL STOPS.**

(8) Slowly release the nitrogen pressure from the leg through the charging adaptor and make sure the shock absorber strut is fully bottomed.

(9) Turn the nosewheel axle approximately 20 degrees horizontally to the left and make sure the self-centering cam disengages. Turn the axle to the center and make sure the self-centering cam engages. Turn the axle to the right and repeat the sequence.

(10) Pressurize the hydraulic system (Chapter 29, MAIN SYSTEM).

(11) Make sure that the cable drum rigging pin is in position, with the nose gear locked down and the nose wheel centralized by the self-centering cam.

(12) Make sure that the steering sleeve and the torque link sleeve are aligned and that the steering disconnect pin is easy to install.

*NOTE: If the sleeves are not aligned, adjust the length of the connecting rod at the steering jack selector.*

(13) Make sure that the connecting rod end is in safety and is locked with wire.

(14) Install the steering disconnect pin and remove the cable drum rigging pin.

(15) At the handwheel lower shaft assembly, loosen the adjustable stop locknuts and screw the adjustable stops into the lugs to increase the clearance.

(16) Inflate the nose gear oleo to a pressure of 25 psi (1.7 bar).

(17) Operate the handwheel slowly between full left and full right. Make sure that the steering jack operates smoothly over the full range.

(18) Make sure that the stroke of the jack is between 2.84 and 2.88 in. (72.1 and 73.1 mm).

(19) Turn the handwheel slowly to full left until the steering jack reaches the limit of its travel. Release the handwheel to let the steering selector valve to return to neutral.

(20) Screw out the stop bolt at the handwheel lower shaft until contact is made with the mounting assembly. Tighten the locknut.

(21) Do paragraphs (19) and (20) with the handwheel turned full right.

(22) Lockwire the stop bolts to the stop and lockwire the locknuts together.

(23) Make sure that the landing gear is locked down and the forked lever is located around the roller on the drag stay.

(24) Stop the hydraulic test rig and release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

(25) Do the steering on/off valve test (para. C.) or close up (para. D).

### C. Steering on/off valve test

(1) Do the preparation (para. A.) as necessary.

(2) Adjust the connecting rod between the mechanical indicating fork and the steering on/off valve so that the valve is between 0.05 and 0.07 in. (1.27 and 1.78 mm) short of maximum extension.

(3) Make sure that the connecting rod ends are in safety and lock with wire.

(4) Remove the nosewheel landing gear ground locking pin.

(5) Set the landing gear control lever to UP. Pump on the airplane ground servicing handpump until nose gear lock is just broken.

(6) Pull the PULL EMERG U/C handle to select the auxiliary hydraulic system.

(7) Set the landing gear control lever to DOWN.

(8) Start the hydraulic test rig and make sure that, with the nose gear unlocked, the nosewheel steering does not operate.

(9) Push the PULL EMERG U/C handle to the normal (fully in) position to reset the auxiliary system dump valve. Make sure that the landing gear moves to the locked down position.

(10) Operate the nose wheel steering handwheel slowly between full left and full right. Make sure that the system operates smoothly over the full range.

(11) Stop the hydraulic test rig and release the hydraulic pressure (Chapter 29, MAIN SYSTEM).

(12) Install the nosewheel landing gear ground locking pin.

(13) Do the close up (para. D.)

### D. Close up

(1) Disconnect the test rig and install the protective caps on the quick release connectors.

(2) Make sure that the hydraulic reservoir level is correct and replenish as necessary (Chapter 12, SERVICING - HYDRAULIC SYSTEM). Close the rear equipment bay access door.

(3) Inflate the nose gear oleo to the correct pressure (Chapter 12, SERVICING - LANDING GEAR).

(4) Install the center floor panel in the flight compartment.

(5) Install the fairing on the left side console.

(6) Lower the airplane to the ground (Chapter 7, JACKING AND TRESTLING).

(7) Make sure that the work area is clean and clear of tools and miscellaneous equipment.

## 3. Steering system friction check *(Figure 502)*

**WARNING: GROUND LOCKING PINS MUST BE INSTALLED WHEN THE MAIN AND NOSE LANDING GEAR ARE IN THE DOWN AND LOCKED POSITION.**

**CAUTION: THIS CHECK CAN BE DONE WITH WEIGHT ON WHEELS WHEN THE CONDITIONS THAT FOLLOW ARE APPLIED:-**

- **NOSE WHEELS CENTRALIZED WITH THE STEERING HANDWHEEL AT NEUTRAL.**
- **STEERING DISCONNECT PIN REMOVED.**

| Equipment/Material | Part/Item No. |
|---|---|
| Spring balance, suitable for reading 0.1 lb (0.05 kg) | Local supply |
| Cord, suitable for wrapping around steering handwheel | Local supply |
| Tape, Suitable for securing cord to the steering handwheel | Local supply |

### A. Procedure

(1) Make sure the ground locking pins are installed (Chapter 10, PARKING AND MOORING).

(2) Make sure the nose wheels are centralized and the steering handwheel is at the neutral position.

(3) Make sure the hydraulic system pressure is released (Chapter 29, MAIN SYSTEM).

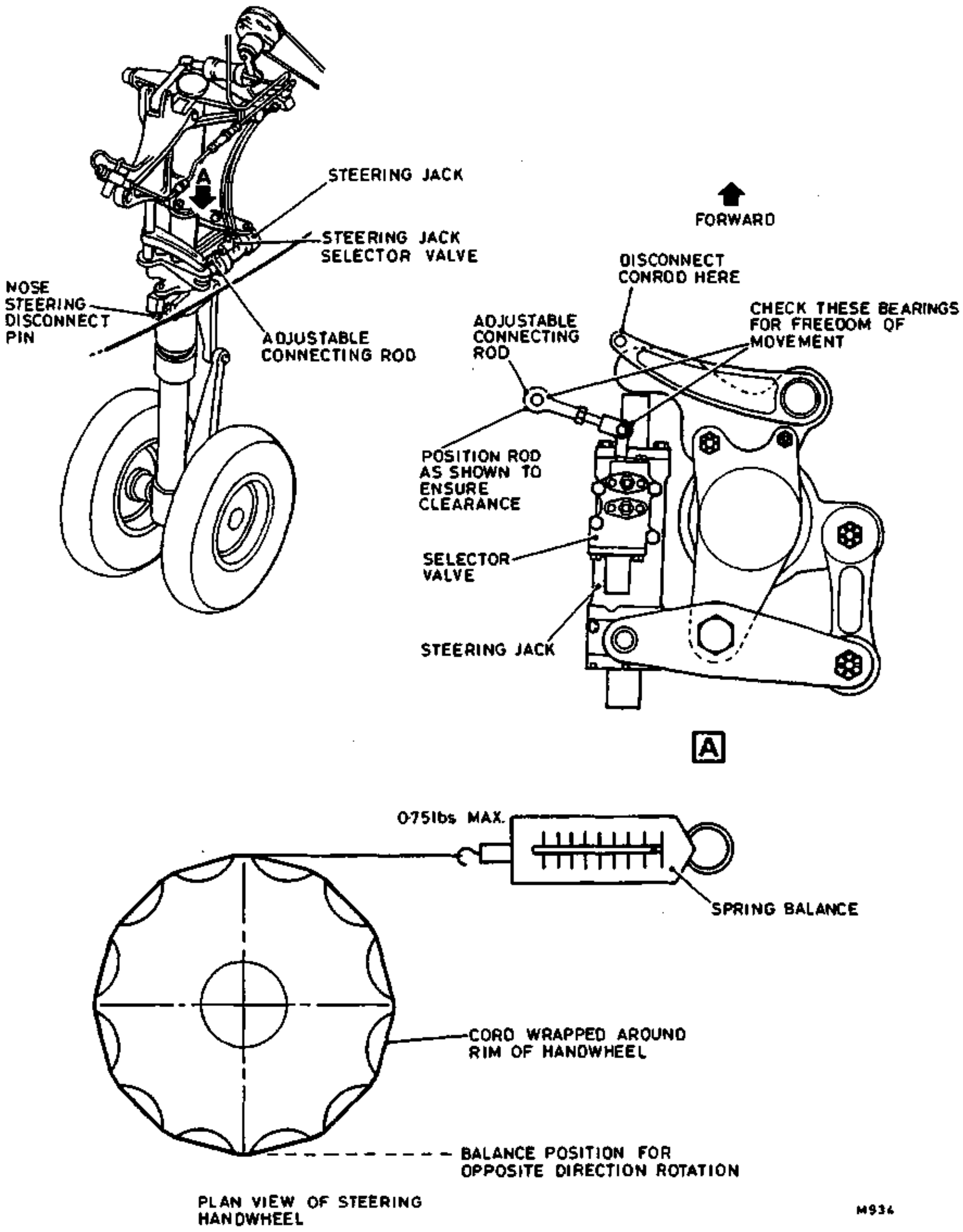
(4) At the nose leg, remove the steering disconnect pin (Chapter 9, TOWING).

(5) Disconnect the adjustable connecting rod to the steering jack selector valve.

(6) Do a check for freedom of movement of the bearing on the adjustable connecting rod and check the bearing on the rod end of the selector valve.

*NOTE: On completion of paragraph (6), make sure the adjustable connecting rod is kept clear of the operating lever.*

(7) Use tape to secure one end of the cord to the steering handwheel, wind the cord around the rim of the steering handwheel (as shown) and attach a spring balance to the cord.


STEERING JACK
STEERING JACK SELECTOR VALVE
NOSE STEERING DISCONNECT PIN
ADJUSTABLE CONNECTING ROD
A
FORWARD
DISCONNECT CONROD HERE
CHECK THESE BEARINGS FOR FREEDOM OF MOVEMENT
ADJUSTABLE CONNECTING ROD
POSITION ROD AS SHOWN TO ENSURE CLEARANCE
SELECTOR VALVE
STEERING JACK
A
0·75lbs MAX.
SPRING BALANCE
CORD WRAPPED AROUND RIM OF HANDWHEEL
BALANCE POSITION FOR OPPOSITE DIRECTION ROTATION
PLAN VIEW OF STEERING HANDWHEEL
M934

Component location for steering friction checks

*Figure 502*

(8) Operate the steering handwheel through the full range of movement.Make sure that the load required to operate the handwheel through the full range of movement does not exceed 0.75 lb (0.34 kg). The load check is to be done in both directions.

*NOTE: If the load exceeds 0.75 lb (0.34 kg), disconnect the steering spring strut to find where in the circuit the friction exists. Further dismantling may be required to identify and rectify the cause of friction.*

(9) If during paragraph (8) backlash in the system is noted, then do a check of the tension of the steering control cables.

(10) Install or connect the components that were disconnected or removed during paragraph (8) and/ or (9).

(11) On completion of the check, remove the cord and spring balance from the steering handwheel.

(12) Connect the adjustable connecting rod.

(13) Install the steering disconnect pin.

### B. Close up

(1) Make sure the work area is clean and clear of tools and any miscellaneous equipment.

## 4. Spring strut break-out load test

Refer to the Component Maintenance Manual (LANDING GEAR) for the break-out load test.

## 5. Functional test of the nose wheel steering

### A. Procedure

(1) Make sure the ground locking pins are installed (Chapter 10, PARKING AND MOORING).

(2) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(3) Install a rigging pin in the cable drum on the aft face of the nose gear bay rear wall.

(4) Make sure that the white rigging mark on the handwheel is at top dead center.

(5) Remove the rigging pin from the cable drum.

(6) Connect a test-rig to the airplane hydraulic system and pressurize the hydraulic system (Chapter 29, MAIN SYSTEM).

(7) Operate the nose wheel steering handwheel slowly between the full left and full right. Make sure that the steering jack operates smoothly over the full range.

(8) Turn the handwheel slowly to full left until the steering jack reaches the limit of its travel. Release the handwheel to enable the steering selector valve to return to neutral.

(9) Turn the handwheel slowly to full right until the steering jack reaches the limit of its travel. Release the handwheel to enable the steering selector valve to return to neutral.

(10) Stop the hydraulic test-rig and release hydraulic pressure (Chapter 29, MAIN SYSTEM).

(11) Disconnect the test-rig and install the protective caps on the quick release connectors (Chapter 29, MAIN SYSTEM).

(12) Lower the airplane to the ground (Chapter 7, JACKING AND TRESTLING).

**B. Close up**

(1) Make sure the work area is clean and clear of tools and any miscellaneous equipment.

# STEERING JACK - SERVICING

## 1. Steering jack selector valve spring housing *(Figure 301)*

| Equipment/Material | Part/Item No. |
|---|---|
| Grease, extreme pressure (low temperature) | 078 (Chapter 20-95-11) |
| Wire, corrosion resistant | 651 (Chapter 20-95-601) |

**WARNING: BEFORE YOU DO THIS TASK YOU MUST MAKE SURE THE AREA IS CLEAN AND IS KEPT CLEAN. THIS IS TO PREVENT CONTAMINATION OF THE HYDRAULIC SYSTEM.**

**CAUTION: BE CAREFUL NOT TO CAUSE DAMAGE TO THE SURFACE FINISH OF THE MATING PARTS.**

### A. Remove the steering jack selector valve spring housing

(1) Release the hydraulic system pressure (Chapter 29, MAIN SYSTEM).

(2) Disconnect the hydraulic pipes at the jack and blank off all open connections.

(3) Disconnect the connecting rod of the selector valve.

(4) Remove and discard the lockwire from the two spring housing retaining bolts, and remove the bolts.

(5) Carefully remove the selector-valve spring housing.

(6) Remove the spring and the two 'C' washers from the plunger.

*NOTE: If during removal of the spring and 'C' washers damage is noted on the plunger, or other components of the selector valve, refer to Vendors CMM 32-50-1103 for repair or replacement of damaged parts.*

### B. Clean and lubricate the steering jack selector valve spring housing and parts

(1) Thoroughly clean and examine the spring housing bore, the spring and washers for corrosion.

(2) Examine and make sure that the vent holes are clean and free from blockages.

(3) Lubricate the spring and 'C' washers with grease (Item 078).

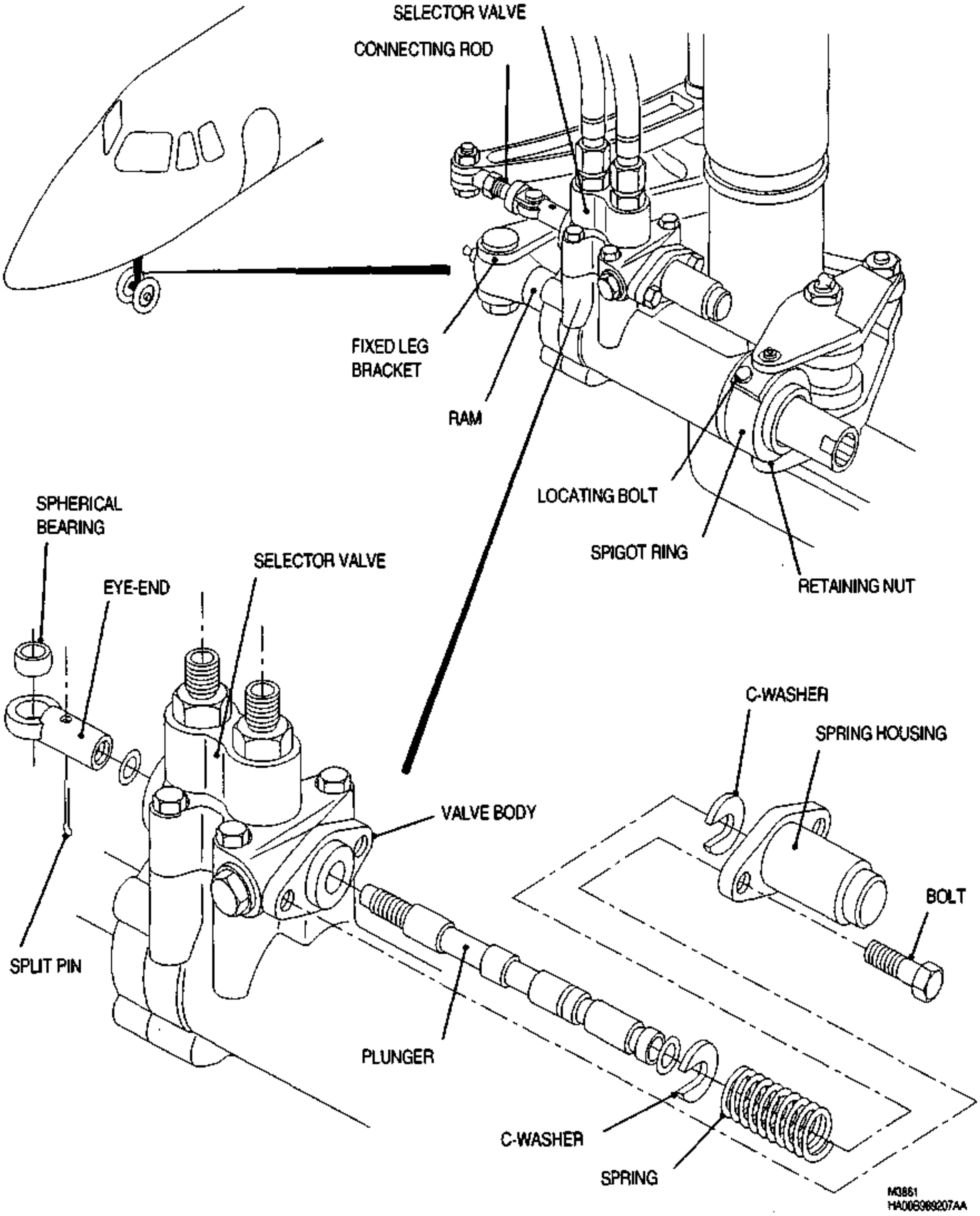
### C. Install the steering jack selector valve spring housing

(1) Install a 'C' washer, the spring and the second 'C' washer on the end of the plunger.

(2) Install the spring housing and the two retaining bolts. Tighten and wirelock the bolts (Item 651).

(3) Attach the the connecting rod of the selector valve.

(4) Remove the blanks from the hydraulic connections. Install and tighten the hydraulic pipes at the jack.



Steering-jack selector valve - servicing
*Figure 301*

# STEERING JACK - REMOVAL/INSTALLATION

## 1. Steering Jack

### A. Removal *(Figure 401)*

(1) Release the hydraulic system pressure (Chapter 29, MAIN SYSTEM).

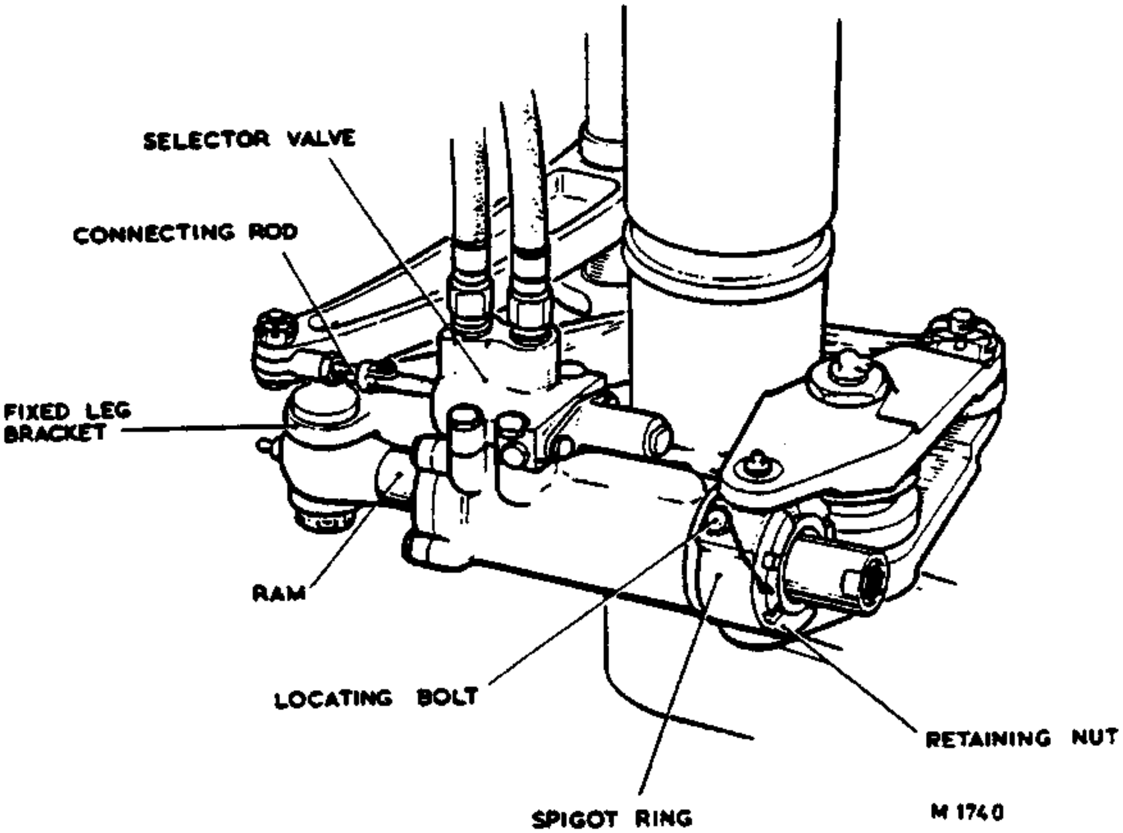
(2) Disconnect the hydraulic pipes at the jack and blank off all open connections.

(3) Disconnect the selector valve control at the connecting rod.

(4) Remove the pin that secures the ram to the leg bracket.

(5) Remove the spigot ring retaining nut and unscrew the locating bolt.

(6) Swing the jack away from the leg to withdraw the rear end from the spigot ring. Install the spigot ring retaining nut on the jack.



Steering jack removal and installation
*Figure 401*

### B. Installation

| Equipment/Material | Part/Item No. |
|---|---|
| Grease | 078 (Chapter 20-95-11) |

NOTE: *For routine lubrication data refer to the Maintenance Schedule.*

(1) Remove the spigot ring retaining nut from the jack body.

(2) Apply grease (Item 078) to the ram end bush and jack body spigot.

(3) Insert the spigot into the spigot ring, align the locating holes and insert the locating bolt. Install the spigot ring retaining nut. Lockwire the locating bolt to the retaining nut.

(4) Insert the pin that secures the ram to the leg bracket and install the washer, nut and split pin.

(5) Attach the connecting rod to the jack selector valve with a bolt, washer, nut and split pin.

(6) Connect and lockwire the hydraulic pipes to the jack.

(7) Apply grease (Item 078) through the greasers.

(8) Adjust the control system and do a functional test on the system (Chapter 32, STEERING).

# STEERING JACK SELECTOR VALVE REMOVAL/INSTALLATION

## 1. Steering Jack Selector Valve *(Figure 401)*

### A. Removal

**CAUTION: MAKE SURE THE AREA IS CLEAN AND IS KEPT CLEAN. THIS IS TO PREVENT CONTAMINATION OF THE HYDRAULIC SYSTEM.**

*NOTE: Install blanks to all disconnected hydraulic components and pipe connectors.*

(1) Release the hydraulic system pressure (Chapter 29, HYDRAULIC POWER - MAIN SYSTEM).

(2) Remove the wirelocking and disconnect the hydraulic pipes to the jack selector valve.

(3) Remove the split pin and nut and disconnect the jack selector valve at the connecting rod.

(4) Remove the wirelocking from the four selector valve attachment bolts.

(5) Remove the four selector valve attachment bolts and remove valve from the steering jack.

### B. Installation

| Equipment/Material | Part/Item No. |
|---|---|
| Grease | 078 (Chapter 20-95-11) |
| De-greasing agent | 230 (Chapter 20-95-201) |
| Wire, corrosion resistant | 651 (Chapter 20-95-601) |
| Suitable container for spillage | Local supply |
| Male and female blanking caps to suit | Local supply |

*NOTE: Remove blanks from hydraulic components and pipe connectors.*

*NOTE: For routine lubrication data refer to the Maintenance Schedule.*

(1) Install the selector valve to the steering jack using the four attachment bolts.

(2) Wirelock the four attachment bolts.

(3) Connect the selector valve control at the connecting rod using the nut and new split pin.

(4) Connect the hydraulic hoses to the selector valve and wirelock.

(5) Pressurize the hydraulic system (Chapter 29, MAIN SYSTEM).

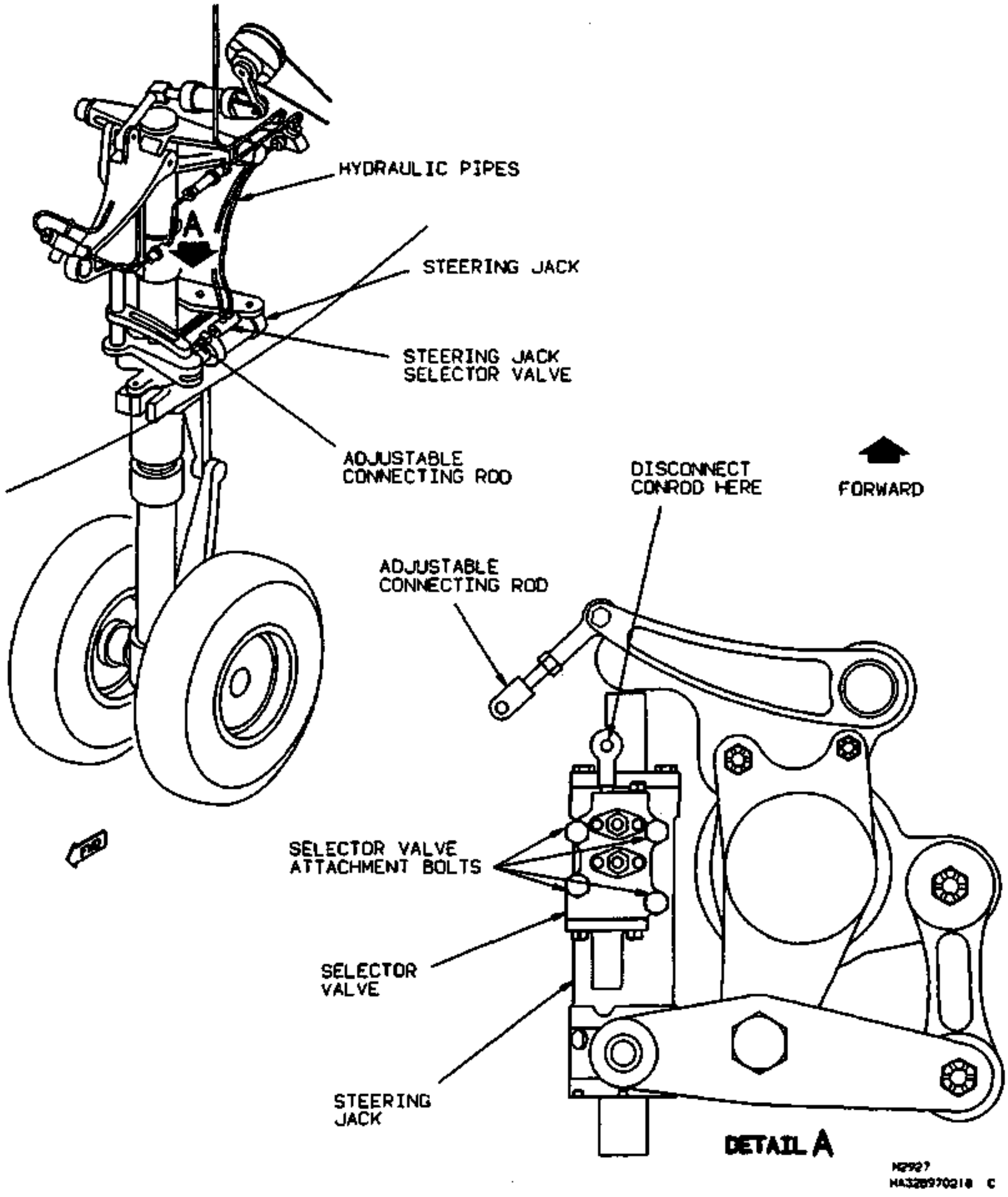
(6) Do a function test of the steering (STEERING).

(7) Examine the selector valve for hydraulic leaks.

(8) Make sure all disturbed connections are locked.

### C. Job close up

(1) Remove all the tools, the materials and equipment. Make sure the work area is clean.



Jack selector valve removal and installation

*Figure 401*

# ELECTRICAL INDICATING SYSTEM - DESCRIPTION AND OPERATION

## 1. General

Landing gear position is indicated by the operation of red and green lamps on an indicator in the flight compartment.

A warning horn, operated on some aircraft by either flap or throttle microswitches, or on other aircraft, by both microswitches, will sound during aircraft approach if the landing gear is not locked down. With Mod 252175 incorporated, the warning horn is operated by the flaps, and throttle microswitches in circuit with a speed switch.

## 2. Description

A red and a green lamp is provided for each landing gear unit on a position indicator situated on the pilots' instrument panel. In parallel with each lamp is a duplicate lamp to cater for filament failure. The main gear circuit to the lamps is made by operation of a leg-down lock microswitch which is actuated by the leg locking mechanism and a door-up lock microswitch operated when the doors lock up. The nose gear has a leg-lock microswitch actuated by the leg locking mechanism and a change-over switch operated by retraction of the gear. Indication is as follows : gear locked down - green lamps on; gear unlocked - red lamps on; gear locked up - no lamps on.

A flaps-down microswitch, located in the control pedestal, is actuated by a cam plate on the flaps selector lever. Throttle microswitches in the rear equipment bay, one for each engine, are actuated by cam plates secured to the throttle cable drums. The microswitches are in circuit with a horn relay and a HORN ISOLATE switch and relay. Additionally, the throttle microswitches are in circuit with a speed switch (see Chapter 34, PITOT/STATIC SYSTEM) when Mod 252175 is embodied. The capsule contacts of the speed switch close at 150 ± 3 knots on rising airspeed and open on a decreasing speed within 2 knots below the closing speed. The switch is located under the co-pilot's seat.

The horn system is also used for cabin depressurization warning (see Chapter 21, PRESSURIZATION) and Mach/airspeed audible warning (see Chapter 34, NAVIGATION).

Electrical power for the lamps is drawn from busbar PE. A separate supply for the horn relay and horn is also taken from busbar PE. Interference suppression is provided by a capacitor connected across the horn terminals.

## 3. Operation

With the main gear locked down, a circuit is made through the contacts of the leg-down lock microswitches to the green indicating lamps. When the leg locks are broken, the leg-down lock microswitches transfer supply through the door-up lock microswitches to the red indicating lamps which remain on during retraction. When the door locks up, the door-up lock microswitches are actuated and the circuit to the lamps is broken.

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...Electrical indicating system - Description and operation continued

The operation of the nose gear microswitches is similar to that of the main gear except that the leg-lock microswitch transfers the supply through the change-over switch to the green indicating lamp and breaking of the leg-lock causes the supply to be transferred to the red indicating lamp. Upon the nose gear locking up, the change-over switch is actuated, breaking the circuit to the lamp and so preventing the green lamp indication that would occur with the leg-lock microswitch again in the locked position.

If the flaps are selected to the approach or landing position and the landing gear is not locked down, a circuit is made through the flaps-down microswitch to energize the horn relay, and the warning horn operates.

A circuit is also made to energize the horn relay by the throttle microswitches closing when the gear is not locked down. If either, or both, throttles are operated within 60% to 70% N1 rev/min and (Mod 252175; warning horn speed switch installed) the indicated airspeed is below 150 ± 3 knots, the circuit to the horn relay is completed.

Horn operation initiated by throttle position can be cancelled by pressing a HORN ISOLATE switch on the pilots' instrument panel; closing the switch energizes a cancel relay which breaks the supply to the horn relay. After the HORN ISOLATE switch is released, the cancel relay remains energized until a throttle is opened or the landing gear is locked down.

* * *

## ELECTRICAL INDICATING SYSTEM - MAINTENANCE PRACTICES

1. Adjustment/ Test

NOTE : For the location of the landing gear microswitches, see Chapter 32, MAIN GEAR, FAIRINGS AND DOORS - Fig.1 and Chapter 32, NOSE GEAR AND DOORS - Fig.1.

A. Adjust nose gear leg lock microswitch

(1) Energize busbar PE (see Chapter 24, GENERAL).

(2) With the landing gear fully locked down, slacken the nuts securing the microswitch body and back off the microswitch until the associated red lamp comes on.

(3) Adjust the body position until the associated red lamp goes off and the green lamp comes on. From this position move the body further towards the striker by moving the backing nut one-half to one full turn. Screw back the locknut and lock the tab washer on backing nut. Wire-lock nuts together.

(4) De-energize busbar.

B. Adjust main gear down lock microswitches

WARNING : ENSURE CLAMPS (HSA 25Y1491) ARE FITTED TO DOOR JACKS.

Adjust each switch as follows :-

(1) Energize busbar PE (see Chapter 24, GENERAL).

(2) With the landing gear fully locked down, slacken the nuts securing the microswitch body and move the microswitch away from the striker until the associated red lamp comes on.

(3) Adjust the body position until the associated red lamp goes out and the green lamp comes on. From this position move the body further towards the striker by turning the backing nut one-half to one full turn. Screw back the locknut and lock the tab washer on backing nut. Wire-lock nuts together.

(4) De-energize busbar.

C. Adjust nose gear change-over microswitch

Adjust switch as follows :-

(1) Jack aircraft (see Chapter 7, LIFTING AND SHORING).

(2) Energize busbar PE (see Chapter 24, GENERAL).

(3) Disconnect nose gear doors.

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(4) Retract landing gear fully, using main system handpump.

(5) Slacken the nuts securing the microswitch body and back off the microswitch until the associated green lamp comes on.

(6) Adjust the body position until the associated green lamp goes off. From this position, move the body further towards the striker by moving the backing nut 2 to 3 turns. The microswitch is operated by contact with the nose leg via a lever on the rear wall of the nose gear bay. Screw back the locknut and lock the tab washer on backing nut. Wire-lock nuts together.

(7) Extend landing gear and reconnect nose gear doors.

(8) De-energize busbar.

(9) Lower aircraft (see Chapter 7, LIFTING AND SHORING).

D. Adjust main gear door-up lock microswitches

Adjust each switch as follows :-

(1) Energize busbar PE (see Chapter 24, GENERAL).

(2) Disconnect the leg fairing (see Chapter 32, MAIN GEAR FAIRINGS); using the aircraft ground servicing pump, retract the landing gear, ensuring that the fairing strut does not foul the aircraft structure, and continue pumping until the wheel well doors are closed and locked.

(3) Slacken the nuts securing the microswitch body and move the microswitch away from the striker until the associated red lamp comes on.

(4) Adjust the body position until the associated red lamp goes out. From this position move the body further towards the striker by turning the backing nut three full turns. Screw back the locknut and wire-lock both nuts to door lock bracket.

(5) Lower the landing gear and re-connect the leg fairing.

E. Adjust flaps down microswitch

(1) Jack aircraft (see Chapter 7, LIFTING AND SHORING).

(2) Energize busbar PE (see Chapter 24, GENERAL).

(3) Remove right-hand side cover from flight compartment control pedestal.

(4) Select flaps to the TO (take-off) position.

(5) With the landing gear up and locked, move the flap selector towards the approach position and check that the warning horn operates just before the approach position is reached. Select flaps to the landing position and check that the horn continues to operate.

(6) Adjust as necessary on the serrated cam plate by slackening both securing bolts and moving the cam plate the required number of serrations. Tighten the bolts and ensure, by inserting a feeler gauge, that at least 0.005 in. pre mod 251582 or 0.010 in. mod 251582 overtravel remains on the microswitch. Lock nuts with split pins.

NOTE : Pre mod 251582 :-
Type 1 HS N1 and 1 HS N3 microswitches.
Post mod 251582 :-
Type 1 HS N66 and 1 HS N64 microswitches.

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(7) Select landing gear down, and check that the warning horn continues to operate during extension and ceases when all three landing gear units are down and locked.

(8) De-energize busbar PE.

(9) Lower aircraft (see Chapter 7, LIFTING AND SHORING).

### D. Adjust throttle operated microswitches at engine control units (e.c.u.'s)

NOTE : The following instructions apply to each microswitch on both e.c.u.'s.

(1) Close throttle and insert rigging pin through support plate into throttle cable drum.

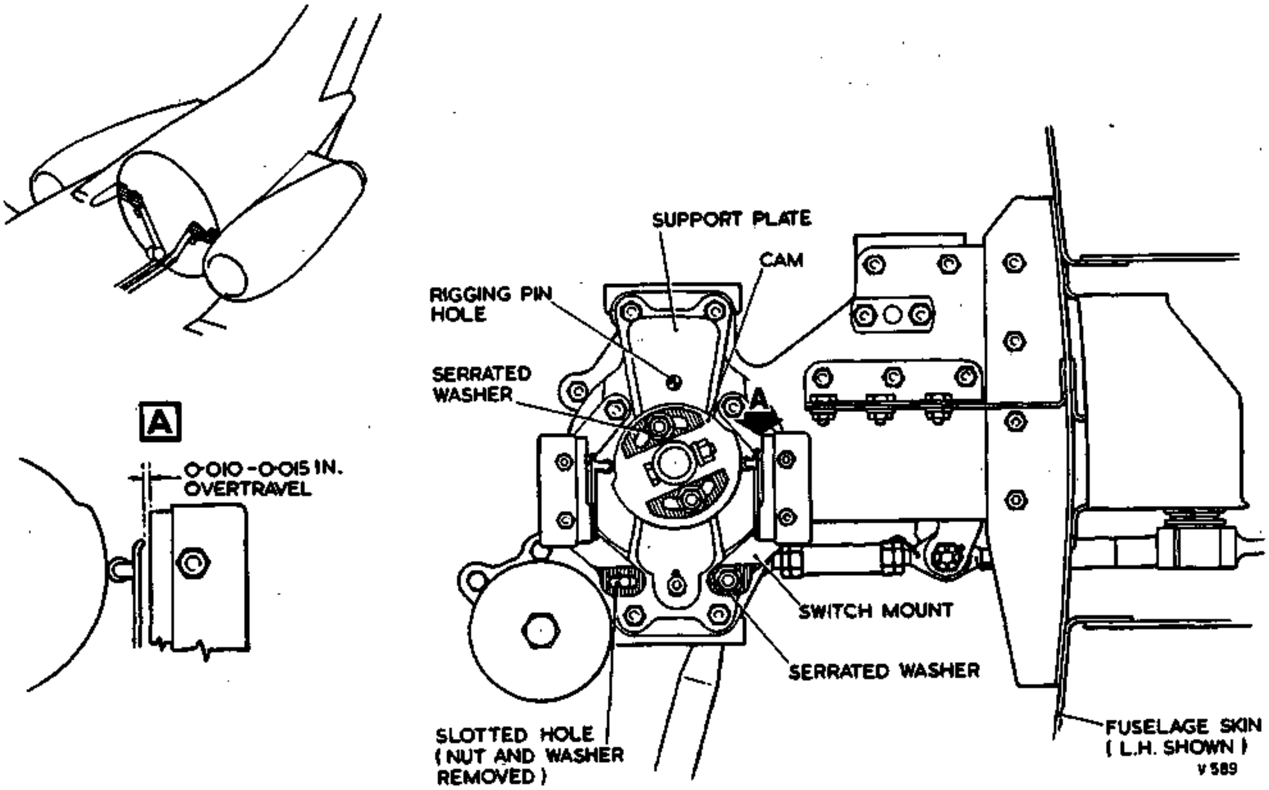
(2) Slacken nuts securing cam and rotate cam so that the larger radius is opposite microswitch roller. Retighten nuts.

(3) Slacken nuts securing microswitch to its mounting and move switch mounts in slotted holes to within the microswitch overtravel limits shown on Fig.201 and with switch "made" retighten nuts.

(4) Remove rigging pin and operate throttle over range of larger cam radius and check switch is "made" at all times.

(5) Run engines and set throttles at 65% N1 rev/min. and adjust cam to trip microswitch XS (right e.c.u.) or XT (left e.c.u.) within 60% - 70% N1 rev/min. Check that microswitches ZY (right e.c.u.) and ZU (left e.c.u.) operate within 40% - 60% N1 rev/min. Retighten cam clamping nuts.

(6) Check that microswitches "break" when switch is in the relaxed position.


SUPPORT PLATE
CAM
RIGGING PIN HOLE
SERRATED WASHER
A
A
0·010-0·015 IN. OVERTRAVEL
SWITCH MOUNT
SERRATED WASHER
SLOTTED HOLE (NUT AND WASHER REMOVED)
FUSELAGE SKIN (L.H. SHOWN)
V589

Throttle operated microswitch adjustment
Fig.201

(7) Jack aircraft (see Chapter 7, LIFTING AND SHORING), remove ground locking pins and, using hydraulic system handpump, retract the landing gear.

(8) Energize PE busbar (see Chapter 24, GENERAL).

(9) Select landing gear down and check that the warning horn continues to operate during extension and ceases when all three landing gear units are down and locked. Fit ground locking pins.

(10) De-energize busbar.

(11) Lower aircraft (see Chapter 7, LIFTING AND SHORING).

* * *

# WARNING HORN - DESCRIPTION AND OPERATION

## 1. Warning horn

### A. General

The warning horn, located on the flight deck, will sound when a signal is received from a system with a fault, or with the incorrect operation of a healthy system.

Electrical power for the horn relay and horn is taken from busbar PE. Interference suppression is provided by a capacitor connected across the horn terminals.

## 2. Airbrakes not shut

### A. Description

A microswitch, mounted at each airbrake inboard hinge bracket on the airbrake stop bracket, is operated when the airbrakes are closed. The switches are connected to a magnetic indicator in the flight compartment.

The microswitches at the airbrake inboard hinge and the main landing gear leg-down lock and the door-up lock microswitches (ELECTRICAL INDICATING SYSTEM) are in circuit with throttle operated microswitches. The nose gear has a leg-lock and a change-over microswitch. When both throttles are operated beyond the 40%-60% rev/min. position with the landing gear locked down and the airbrakes open, the warning horn will sound.

### B. Operation

When the landing gear is locked down, main gear doors locked up, and the airbrakes are not completely shut, operation of both throttles beyond the 40%-60% rev/min. position will complete a circuit and cause the warning horn to sound.

## 3. Landing gear

### A. Description

A warning horn, operated by the flaps and throttle microswitches, in conjunction with the speed switch (Mod.252175), will sound during airplane approach if the landing gear is not locked down.

*NOTE: Mod. 252175 introduces a speed sensitive switch to the warning horn system.*

A flaps-down microswitch, located in the control pedestal, is actuated by a cam plate on the flaps selector lever. Throttle microswitches in the rear equipment bay, one for each engine, are actuated by cam plates secured to the throttle cable drums. The microswitches are in circuit with a horn relay and a HORN/ISOLATE switch and relay.

### B. Operation

With the main gear locked down, a circuit is made through the contacts of the leg-down lock microswitches to the green annunciators. When the leg locks are broken, the leg-down microswitches transfer supply through the door-up lock microswitches to the red annunciators which remain on during retraction. When the door locks-up, the door-up lock microswitches are actuated and the circuit to the annunciators is broken.

The operation of the nose gear microswitches is similar to the main gear except the leg-lock microswitch transfers the supply through the change-over switch to the green annunciator and breaking of the leg-lock causes the supply to be transferred to the red annunciator. When the nose gear locks up, the change-over switch is actuated and the circuit to the annunciators is broken.

If the flaps are selected to the approach or landing position and the landing gear is not locked down, a circuit is made through the flaps-down microswitch to energize the horn relay, and the warning horn operates.

Mod.252175. If either or both throttles are operated within 60% to 70% N1 rev/min. and indicated airspeed is below 150 ± 3 knots, the warning horn will operate.

A circuit is also made to energize the horn relay by the throttle microswitches closing when the gear is not locked down. If either, or both, throttles are closed below 60% N1 rev/min. position, the circuit to the horn relay is completed.

Horn operation initiated by throttle position can be cancelled by pushing the HORN ISOLATE button on the pilots instrument panel, which energizes a cancel relay and breaks the supply to the horn relay. After the HORN ISOLATE button is released, the cancel relay remains energized until the throttles are opened or the landing gear is locked down.

## 4. Cabin De-Pressurization

### A. Description

Cabin air pressure conditions are monitored by a cabin rate of climb indicator, cabin altimeter and a cabin differential pressure indicator, all located on the co-pilot's instrument panel.

A pressure (altitude) switch, situated on panel DA, will operate if the cabin altitude rises to 9,300 ft. to light a CABIN ALT warning lamp on the pilots center instrument panel and sound the warning horn. The horn can be cancelled by pushing a HORN ISOLATE button positioned below the CABIN ALT warning lamp.

### B. Operation

If the cabin altitude rises above 9,300 ft., a capsule-operated switch, routes a supply from busbar PE to relay CA to activate the warning horn and the red warning lamp CABIN ALT annunciator on the pilots center instrument panel.

Operation of the HORN ISOLATE button, breaks the electrical hold on circuit, relay CA de-energizes and the warning horn stops. The hold on circuit will not reset when you release the HORN ISOLATE button.

The warning can only be cancelled and the circuit reset when the cabin altitude is reduced below 9,300 ft. The capsule-operated switch will open allowing the capacitors to discharge and the CABIN ALT annunciator will go out.

## 5. Pitot/Static and Mach/Airspeed warnings

### A. Description

The Mach/airspeed audible warning horn is energized by a preset Mach/airspeed switch, or for test purposes only, a test switch.

The Mach/airspeed switch is a pressure operated switch that makes an electrical circuit when a preset Mach number or airspeed is exceeded. The contacts break the circuit when the Mach number or airspeed falls below the preset figures.

### B. Operation

The Mach/airspeed switch contains an airspeed capsule which responds to the pitot/static differential pressure and an altitude capsule which responds to the static pressure only. The airspeed capsule actuates a pair of contacts which make at a preset airspeed. The altitude capsule in conjunction with the airspeed capsule actuates an additional pair of contacts which make at a preset Mach number. When either pair of contacts make, an external electrical circuit is completed.

The electrical supply to operate two control relays is routed through the switch contacts of both Mach/ airspeed switches to the energizing coil of one relay, via contacts on a second relay. With the first relay energized, the supply circuit to the horn and to the energizing coil of the second relay is completed. With the second relay energized, the supply circuit to the energizing coil of the first relay is disconnected. This in turn, disconnects the electrical supply to the horn and second relay energizing coil. With the second relay de-energized the supply circuit to the energizing coil of the first relay is completed. This intermittent operation continues all the time maximum operating Mach number or permissible indicated airspeed is exceeded.

## 6. Engine controls - Power control

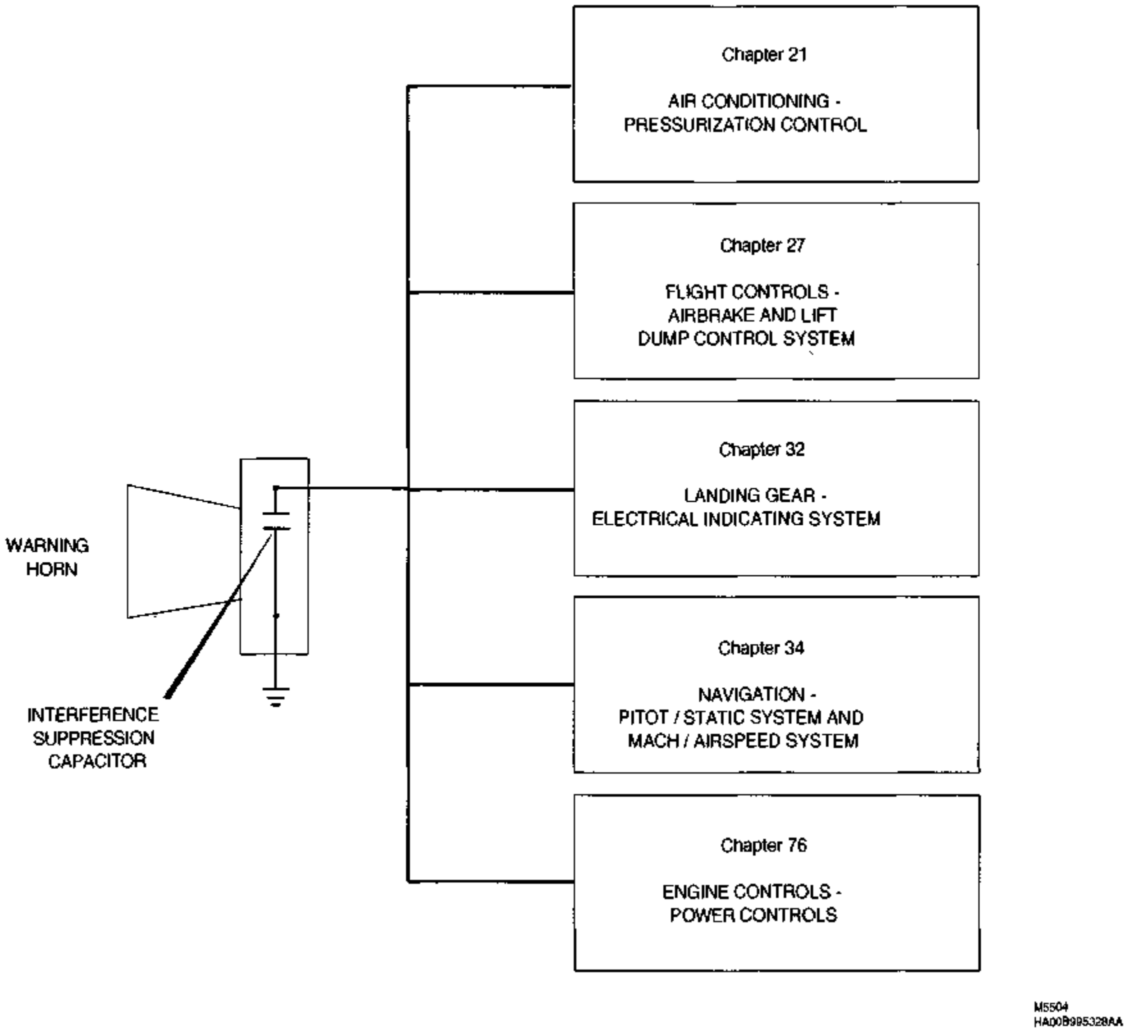
### A. Description

Throttle microswitches, in the rear equipment bay (one for each engine), are operated by a cam plate on the throttle cable drums. The microswitches are in a circuit with a horn relay and a HORN/ISOLATE switch and relay.

### B. Operation

A circuit is made to energize the horn relay by the throttle microswitches closing when the gear is not locked down. If either, or both, throttles are closed below the 60% N1 rev/min. position, the circuit to the horn relay is completed.

Horn operation initiated by throttle position can be cancelled by pushing the HORN ISOLATE button on the pilots instrument panel, which energizes a cancel relay and breaks the supply to the horn relay. After the HORN ISOLATE button is released, the cancel relay remains energized until the throttles are opened or the landing gear is locked down


Chapter 21
AIR CONDITIONING - PRESSURIZATION CONTROL
Chapter 27
FLIGHT CONTROLS - AIRBRAKE AND LIFT DUMP CONTROL SYSTEM
Chapter 32
LANDING GEAR - ELECTRICAL INDICATING SYSTEM
Chapter 34
NAVIGATION - PITOT / STATIC SYSTEM AND MACH / AIRSPEED SYSTEM
Chapter 76
ENGINE CONTROLS - POWER CONTROLS
WARNING HORN
INTERFERENCE SUPPRESSION CAPACITOR
M5504
HA00B985328AA

Warning horn - operating system
*Figure 1*

# WARNING HORN - REMOVAL/INSTALLATION

## 1. Warning horn

### A. Removal

(1) Isolate the airplane electrical supplies (Chapter 24, ELECTRICAL POWER).

(2) Remove the pilots seat (Chapter 25, CREW SEATS).

(3) Refer to IPC 32-60 to locate the warning horn. Remove all necessary trim to gain access.

(4) Remove the nuts, bolts and washers used to secure the warning horn to the mounting bracket.

(5) Make a note of the wire numbers connected to the warning horn, disconnect the wires from the warning horn electrical connections.

(6) Remove the warning horn.

### B. Installation

(1) Connect the wires to the warning horn electrical connections.

(2) Align the warning horn mounting holes and the holes in the mounting bracket, install the nuts, bolts and washer. Tighten the bolts.

(3) Install trim removed at A.(3).

(4) Install the pilots seat (Chapter 25, CREW SEATS)

(5) Functionally test the operation of the warning horn (ADJUSTMENT/TEST).

### C. Close up

(1) Make sure that the work area is clean and clear of tools and miscellaneous equipment.

# WARNING HORN - ADJUSTMENT/TEST

## 1. Test of the warning horn

### A. Procedure

(1) Energize the airplane d.c. busbars (Chapter 24, ELECTRICAL POWER).

(2) Momentarily, press the warning horn test switch.

(3) Make sure the warning horn sounds.

*NOTE: The audible warning horn can also be sounded by steps in the list of chapters that follow:*
*Chapter 21, AIR CONDITIONING, Chapter 27, FLIGHT CONTROLS, Chapter 34, NAVIGATION, Chapter 76, ENGINE CONTROLS).*

## 2. Test of the warning horn isolate system

### A. Preparation

*NOTE: To do this test it is necessary to install locally manufactured 'U' clamps to airbrake microswitches JQ and KQ. The microswitches must remain closed for the test.*

| Equipment/Materials | Part/Item No. |
|---|---|
| Two wing point jacks | Chapter 7, JACKING AND TRESTLING |
| One rear jack point | Chapter 7, JACKING AND TRESTLING |
| Pitot/Static Test Set | Druk |
| 'U' clamps | Local supply |

(1) Install the landing gear locking pins (Chapter 10, PARKING AND MOORING).

(2) Raise the airplane on jacks to clear the wheels from the ground (Chapter 7, JACKING AND TRESTLING).

(3) Set both throttle levers to fully open.

(4) Energize the airplane d.c. busbars (Chapter 24, ELECTRICAL POWER).

(5) Set the flaps to 45 degrees and operate the hydraulic hand pump to move the flaps (Chapter 27, FLAPS).

(6) Set the airbrakes to the out position, operate the hydraulic hand pump to move the airbrakes to the selected position (Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM).

(7) Release the airplane hydraulic pressure (Chapter 29, MAIN SYSTEM).

(8) Locate airbrake microswitches JQ (left airbrake) and KQ (right airbrake) (Chapter 27, AIRBRAKE AND LIFT DUMP CONTROL SYSTEM).

  (a) Install locally manufactured 'U' clamp to microswitch JQ.

  (b) Install locally manufactured 'U' clamp to microswitch KQ.

## B. Test

(1) Remove the nose landing gear locking pin.

  (a) Set the landing gear selector to 'UP'.

  (b) Operate the hydraulic hand pump to retract the nose gear sufficiently to changeover the contacts on the nose leg lock microswitch. The green annunciator N.GEAR will go out and the red annunciator N.GEAR will come on.

(2) Make sure the warning horn sounds.

*NOTE: Do not operate the hydraulic hand pump to close the flaps.*

(3) Set the flap lever to the fully closed position to reset the flap microswitch.

(4) Make sure the warning horn does not sound.

(5) Move both the throttle levers to fully closed and make sure the warning horn sounds.

(6) Press the HORN ISOLATE button on LH throttle lever and make sure the warning horn does not sound.

(7) Move both the throttle levers to fully open to reset the warning horn system.

(8) Move both the throttle levers to fully closed and make sure the warning horn sounds.

(9) Press the HORN ISOLATE button on LH throttle lever and make sure the warning horn does not sound.

(10) Connect a suitable Pitot/Static test set to the LH and RH pitot heads (Chapter 34, PITOT STATIC SYSTEM). Slowly increase pitot pressure to an indicated airspeed of 160 knots to reset the warning horn isolate relays.

(11) Slowly, release pitot pressure until warning horn sounds. Warning horn should operate at 150 knots ± 2 knots decreasing pressure.

(12) Press the HORN ISOLATE button on LH throttle lever and make sure the warning horn does not sound.

(13) Release the pitot pressure from LH and RH pitot heads and remove the test set (Chapter 34, PITOT STATIC SYSTEM).

(14) Remove 'U' clamps from airbrake microswitches JQ (LH airbrake) and KQ (RH airbrake).

(15) Set the airbrakes to the fully in position.

(16) Set the landing gear selector to 'DOWN'.

(a) Operate the hydraulic hand pump to lock the nose gear in the down position.

(b) Make sure the red N.GEAR annunciator is off and the green N.GEAR annunciator is on.

(c) Install the nose landing gear locking pin.

(17) Continue to operate the hydraulic hand pump to fully close the flaps and airbrakes.

(18) De-energize the airplane busbars (Chapter 24, ELECTRICAL POWER).

(19) Lower the airplane to the ground and remove the jacks (Chapter 7, JACKING AND TRESTLING).

**C. Close up**

(1) Make sure that the work area is clean and clear of tools and miscellaneous equipment.

# MECHANICAL INDICATING SYSTEM - DESCRIPTION

## A. Main gear

An indicator protrudes from a hole in the wing surface outboard of each main gear to provide a visual indication that the gear is locked down. The indicator, which consists of a curved rod attached to a spring-loaded lever, is connected by a Teleflex cable to a slotted cam lever mounted on the wing structure above the main gear. A roller, operating in the slot of the cam lever, is carried on a lever pivoted on the wing structure and is connected to the main gear locking assembly via a linkage. The indicator is spring loaded to the unlocked position.

## B. Nose gear

Mechanical indication that the nose gear is locked down is provided by an indicator rod protruding from the top surface of the control pedestal in the flight compartment. The indicator consists of the plain portion at one end of a Teleflex cable assembly; the other end of the cable is secured to a lever attached to a shaft at the top of the nose gear bay. A fork secured to a lever attached to a shaft at the top of the nose gear bay. A fork secured to the shaft is rotated, during the gear locking and unlocking action, by a pin on a lever pivoted to the drag stay, the lever being connected to the steering on/off valve, the internal spring of which loads the indicator to the unlocked position.

# MECHANICAL INDICATING SYSTEM - MAINTENANCE PRACTICES

## 1. Procedure

**WARNING: DOOR ACTUATOR CLAMPS (25Y1491A) MUST BE INSTALLED TO THE DOOR ACTUATORS WHEN WORKING NEAR THE MAIN LANDING GEAR.**

### A. Preparation

(1) Jack the airplane (Chapter 7, LIFTING AND SHORING).

(2) Release the main system hydraulic pressure (Chapter 29, HYDRAULIC POWER).

*NOTE: Use the hydraulic system servicing hand pump to obtain landing gear movement during the following adjustments.*

### B. Lubrication - nose gear *(Figure 201)*

| Equipment/Materials | Part/Item No. |
|---|---|
| Silicone grease | 046 (Chapter 20-95-11) |
| Grease (low temperature) | 078 (Chapter 20-95-11) |

(1) Disconnect the Teleflex cable adjustable-end at the Teleflex lever.

(2) Clean the cable rod end and the cable outer sleeve with a lint-free cloth.

(3) Slide the rubber end seal back from the outer sleeve and make sure the seal is clean and has no cracks.

(4) Put a thin layer of silicone grease (Item 046) on the sliding portion of the rod end.

(5) Slide the rubber seal in to position over the outer sleeve.

(6) Push and pull the Teleflex cable in its outer sleeve and make sure the cable has full and free movement.

(7) Reconnect the Teleflex cable to the Teleflex lever.

(8) Clean the bearing plate assembly with a lint-free cloth.

(9) Apply grease (Item 078) to the bearing plate assembly.

(10) Clean the lever assembly with a lint-free cloth.

(11) Apply grease (Item 078) to the lever assembly.

### C. Adjust mechanical indicating system - nose gear *(Figure 201)*

(1) Measure the clearance between the fork lever and the drag stay pick-up fitting. Adjust the shims as necessary.

(2) Remove the nose gear ground locking pin.

(3) With the nose gear down, but unlocked, adjust the Teleflex cable so the indicator in the flight compartment is 0.10 in. above the face of the control pedestal.

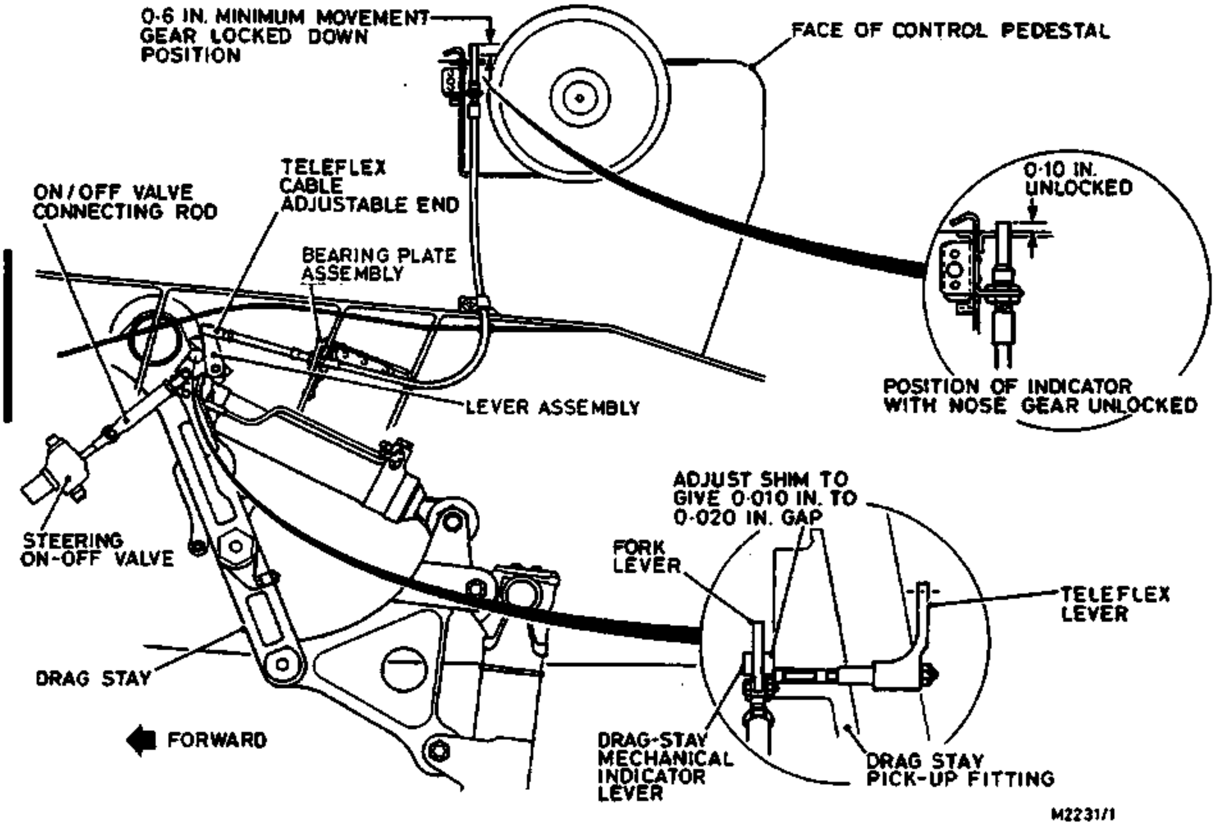
(4) Retract the nose gear fully and make sure that, during retraction, the mechanical indicator lever on the drag stay clears the fork lever. Make sure there is no locked-down indication during retraction or at the completion of retraction.

(5) Lower the gear, and make sure on locking down, the mechanical indicator lever re-engages in the fork lever. Make sure the indicator in the flight compartment moves up the correct minimum amount of 0.6 inches from the unlocked position.

(6) Adjust the connecting rod from the forked lever to the nose wheel steering on/off valve (Chapter 32, STEERING).

(7) Connect and lock all items that were disconnected in paragraphs C.

(8) Install the ground locking pins and lower the airplane (Chapter 7, LIFTING AND SHORING).


0·6 IN. MINIMUM MOVEMENT GEAR LOCKED DOWN POSITION
FACE OF CONTROL PEDESTAL
TELEFLEX CABLE ADJUSTABLE END
ON/OFF VALVE CONNECTING ROD
BEARING PLATE ASSEMBLY
0·10 IN. UNLOCKED
LEVER ASSEMBLY
POSITION OF INDICATOR WITH NOSE GEAR UNLOCKED
ADJUST SHIM TO GIVE 0·010 IN. TO 0·020 IN. GAP
STEERING ON-OFF VALVE
FORK LEVER
TELEFLEX LEVER
DRAG STAY
FORWARD
DRAG-STAY MECHANICAL INDICATOR LEVER
DRAG STAY PICK-UP FITTING
M2231/1

Mechanical indicating system adjustment - nose gear
*Figure 201*

**D. Adjust mechanical indicating system - main gear** *(Figure 202)*

(1) With the landing gear locked down, adjust the length of the Teleflex cable to obtain the correct clearance between the top of the indicator arm and the edge of the hole in the shroud rib. Adjust both ends of the cable as necessary; wire-lock after adjustment.

(2) With the landing gear locked up, check that the indicator protrudes from the wing skin by not less than 0.15 in. and not more than 0.30 in.

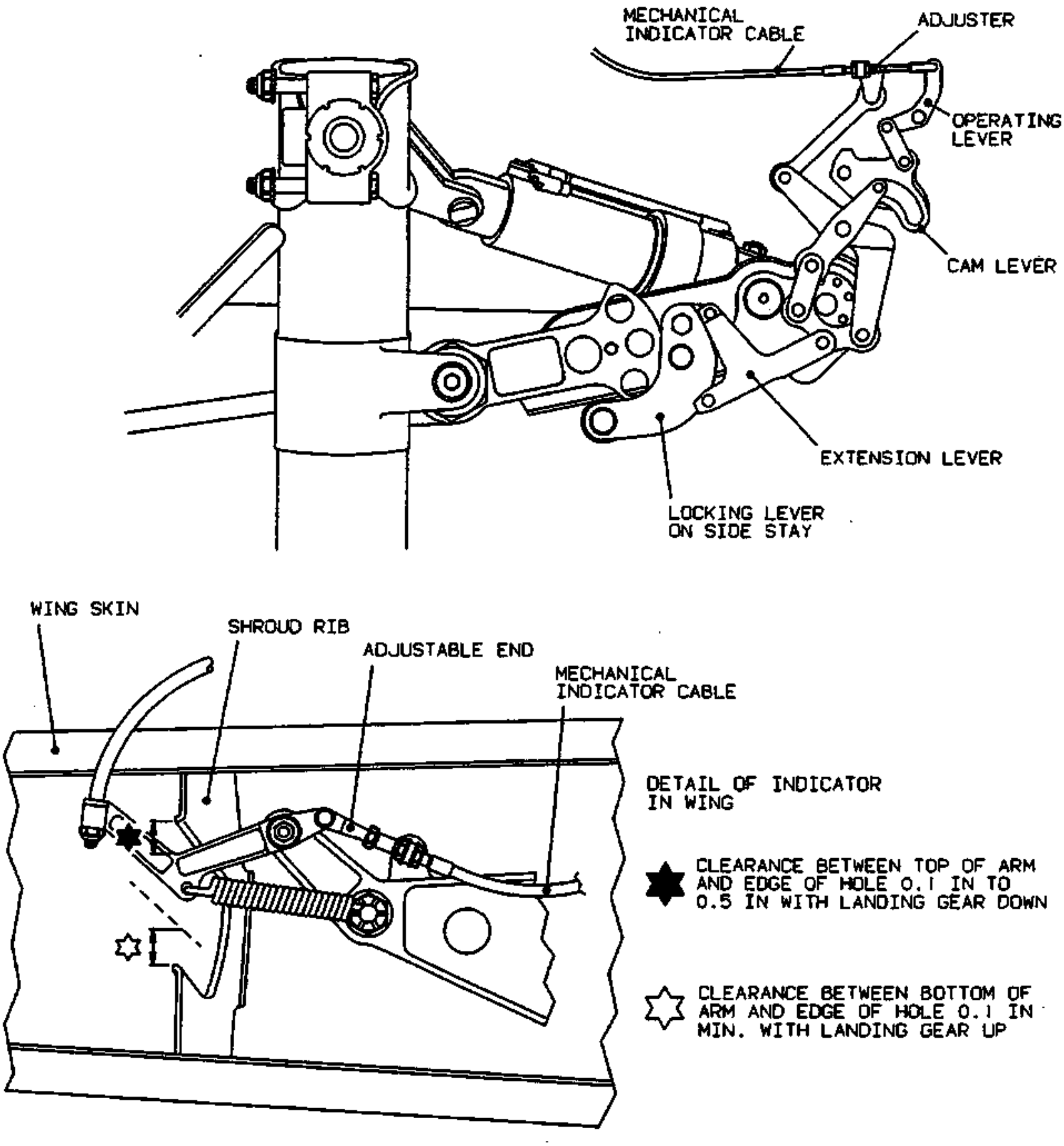
(3) Lower the landing gear and check that the indicator protrudes from the wing skin by not less than 1.5 in., the measurement being made at 90 deg. to the wing skin.

(4) Retract the landing gear and check that the indicator moves to between 0.15 in. and 0.30 in. of the wing skin as soon as the gear is unlocked.

(5) With the landing gear locked up, check that the correct clearance is obtained between the bottom of the indicator arm and the edge of the hole in the shroud rib.

(6) Check that the indicator arm is clear of the shroud rib, in both the retracted and lowered positions, by a minimum of 0.10 in.

(7) Check that the clearance between the indicator and the hole in the wing skin is 0.03 in. throughout the full range movement.


MECHANICAL INDICATOR CABLE
ADJUSTER
OPERATING LEVER
CAM LEVER
EXTENSION LEVER
LOCKING LEVER ON SIDE STAY
WING SKIN
SHROUD RIB
ADJUSTABLE END
MECHANICAL INDICATOR CABLE
DETAIL OF INDICATOR IN WING
✶ CLEARANCE BETWEEN TOP OF ARM AND EDGE OF HOLE 0.1 IN TO 0.5 IN WITH LANDING GEAR DOWN
✡ CLEARANCE BETWEEN BOTTOM OF ARM AND EDGE OF HOLE 0.1 IN MIN. WITH LANDING GEAR UP
M2806
HA32B960079 C

Mechanical indicating system adjustment - Main gear
*Figure 202*

# CHAPTER

# 33

# LIGHTS

## Chapter 33

## LIGHTS

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* No separate description
+ No separate maintenance practices

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| + | 33-10-03 | FLIGHT COMPARTMENT LIGHTING | | |
| * | | 33-10-11 | Pillar lamps - pedestal and CAGS panel | Thorn 80/10/0855 |
| * | | 33-10-21 | Dimmer switch (roof and controllers) | Thorn 01-0105-18 or |
| | | | Dimmer switch (Mod.255974) | Thorn 01-0102-25 |
| * | | 33-10-31 | Spot lamp | Lewis Dixon M2641 |
| | | | Switch, spot lamp | Honeywell 1TP1-3 |
| | | | Chart lamps | Thermotank PD1798/67 |
| * | | 22-10-21 | Dimmer switch, chart lamps | Thorn 01-0083 (modified) |
| | | | Pad lamps | Butlers 159/49 |
| * | | 33-10-21 | Dimmer switch, pad lamps | Thorn 01-0014 |
| * | | 33-10-41 | Sidewall storm lamps | Walters H1800C/1 |
| | | | Panel DA storm lamp | Walters H1800C/1 |
| | | | Switch, storm lamps | Pye U523 |
| | | | Wander lamp | BAe 25NF7057A |
| | | | Socket, wander lamp | Bulgin SA 2026 |
| | | | Switch, wander/chart lamps | Honeywell 1TP12-1 |
| | | | Coaming lamps | Bulgin MES 35 |
| | | | Dimmer switches, coaming lamps | Thorn 01-0102-23 |
| | | | Switch emergency(standby) | Pye U523 |
| | | | Engine instrument lighting dimmer | Berco L25-3Ω |
| | 33-14-02 | CENTRAL ATTENTION GETTING SYSTEM (C.a.g.s.) | | |
| | | | C.a.g.s. logic unit | BAe 25NF 11025 |
| | | | Flasher unit | Page C1775 |
| | | | Fail lamp | Thorn L1034-V135E |
| | | | Cancel switch | Honeywell 2TL1-51 |
| | | | Test switch | Honeywell 6A-43 |
| | | | Override switch | Honeywell 6AT-4 |
| | | | Dimmer | Spectrol Reliance CW05-10K |
| | | | Power transistor | Motorala MJE 2955 |
| | | | Annunciators (lampholder) | Page C8492/004 |

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| * | | 33-20-11 | Fluorescent strip lamps - cabin and toilet | Atlas T5 |
| | | | Inverter/ballast units | Thorn R2410/80 |
| | | | Switch, cabin lamps (roof panel) | Pye U2032 |
| | | | Switch, cabin lamps (galley panel) | Honeywell 2TP12-3 |
| | | | Switch (toilet lamp) | Honeywell 2TP12-3 |
| | | | Galley lamps | Walters H1800C/1 |
| | | | Switch, galley lamps | Honeywell 1TP12-3 |
| * | | 33-20-31 | Standby lamp, toilet | Bulgin SBC4/B |
| | | | Standby lamp, cabin | Walters H1800C/1 |
| | | | Switch, standby lamps | Pye U523 |
| * | | 33-20-41 | Cabin safety notices lamps | Walters H1300A |
| | | | Switches, safety notices | Pye U523 |
| * | | 33-20-61 | Passenger reading lamps | Wemac 2195/BASIC/M |
| | | | Switches, reading lamps | Honeywell M82-PB3-T2 |
| | | | Roof lamp | Walters H1400 |
| | | | Switch, roof lamp | Honeywell 1TP4-3 |
| | | | Switch, roof lamp | Honeywell 1TP4-3 |
| | | | Step lamp, forward | Thorn 03-0034 |
| | | | Step lamp, aft | Thorn 03-0033 |
| | | | Switch, step lamp | Honeywell 1TP4-3 |
| + | 33-30-01 | REAR EQUIPMENT BAY LIGHTING | | |
| | | | Lamp | Butler 4N1095/1 |
| | | | Switch | AEI LHA 1/BG205 |
| + | 33-40-01 | EXTERIOR LIGHTING | | |
| | | | Lamp-navigation, wingtip | Grimes 22875/1/GREEN<br>Grimes 22875/2/RED |
| | | | Switch | Pye U523 |
| * | | 33-40-11 | Lamps-navigation, tail | Thorn 80/10/0200 |
| | | | Switch | Pye U523 |
| * | | 33-40-21 | Lamp-landing | General Electric 4553 or 4581(Mod. 255789) |
| | | | -taxiing | General Electric 4505 or 4594(Mod 255789) |
| | | | Switch | Pye U523 |
| * | | 33-40-42 | Beacon, anti-collision | Grimes G 9950/1 (with socket facing forward) |
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| * | | 33-40-51 | Spotlamp-wing ice detection | Walters H-1800C |
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+ 33-50-01 EMERGENCY LIGHTING

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| 33-50-31 | Piston inertia switch | Graviner 18C |
| | Switch | Pye U523 |
| | Passenger compartment lamp | Walters H 1800C |

+ 33-50-03 EMERGENCY LIGHTING (Mod.256229)

* * *

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## LIGHTS - GENERAL

1. Flight compartment lighting

Scuttle-mounted red lamps and white lamps illuminate the main instrument panels; lamps concealed within a Plasteck panel illuminate the system control panel CG in the roof. Storm lamps, Central Attention Getting System (CAGS) panel and control pedestal lamps, crew chart lamps, fuse and/or circuit breaker panel lamps, and a standby compass lamp are also fitted.

Power supplies are arranged so that essential lighting is available from the aircraft battery.

2. Passenger compartment lighting (including vestibule and toilet compartment).

Normal lighting from fluorescent lamps and standby lighting from single filament bulbs is available in the passenger and toilet compartments. Additional lighting from individual, passenger-operated, reading lamps is provided in both passenger service units. Vestibule lighting is provided by a roof lamp and step lamps adjacent to the entry stairs. Lighting is also provided in the galley unit, above the work surface.

3. Exterior lighting

A navigation lamp, landing lamp and taxiing lamp are fitted to each wing, and a navigation lamp and anti-collision beacon to the bullet fairing and upper vertical stabilizer respectively; a second anti-collision beacon is mounted on the underside of the fuselage. A splotlamp is fitted in the fuselage to enable in-flight ice inspection of the left wing leading-edge.

4. Emergency lighting

Emergency lighting, when fitted to fulfil operators' special requirements, is provided by the vestibule lamp and by a lamp in the passenger compartment. This latter lamp illuminates the escape hatch and the right wing to facilitate emergency escape.

5. Spare filaments

A box containing a number of spare filaments is mounted on the flight compartment bulkhead, directly behind the left-hand crew member's seat.

* * *

# FLIGHT COMPARTMENT LIGHTING - DESCRIPTION AND OPERATION

## 1. General

For the location of the flight compartment lamps and switches refer to Fig.1. For sources of electrical power supply refer to Fig.2.

## 2. Instrument and panel lighting

The main instrument panel facia lighting is provided by strip-mounted, ring connected, red and white lamps alternately mounted on the lower canopy rail (if applicable) and under the main instrument panel coaming. The lamps are controlled by two on-OFF dimmer switches labelled INSTRUMENTS RED and INSTRUMENTS WHITE on panel PX. In addition, the INSTRUMENT WHITE dimmer switch also controls an optional left instrument panel spot lamp at frame 2.

Also fitted on panel PX is an on-OFF ROOF AND CONTROLLERS dimmer switch which effects control of the following circuits :-

Ring-connected lamps in the roof Plasteck panels
C.A.G.S. panel pillar lamps(s)
Pillar lamps on the central pedestal
Standby compass and oxygen regulator integral lighting
Navigational aids integral lighting

The flight system instruments illumination is individually controlled by its own FLIGHT SYSTEM on-OFF dimmer switch on panel PX. The supply voltage is derived from the output of a step-down auto-transformer located, as applicable, on panel DA, junction box SP or DU; the transformer input being connected to XE or XS1 busbar.

To special order only, an ANNUNCIATOR DIM-BRIGHT switch is fitted on the flight compartment control pedestal. This switch provides two controlled levels of illumination for the autopilot and flight system annunciators, on the main instrument panels. On aircraft with annunciator dimming control fitted, a third level of illumination control is provided when Mod.256336 is embodied. This introduces revised wiring, a replacement diode and ANNUNCIATOR DIM-MED-BRIGHT switch.

On aircraft with Mod.252215 embodied, power transistors are mounted on heat sinks in panel DA. The existing ROOF AND CONTROLLERS on-OFF dimmer switch on panel PX and its associated wiring is modified so that control of the power transistors base current regulates the supply voltage required for effective dimming control of the circuits previously described.

The engine related instruments on the centre instrument panel are integrally illuminated, the level of illumination being controlled by an ENG INST dimmer also located on the centre instrument panel. Supply to the dimmer circuit is from XS1 busbar via a step-down transformer located under the co-pilots seat. The instruments so controlled are :- Fuel flow indicators, N1 and N2 r.p.m. indicators and the interstage turbine temperature indicators.

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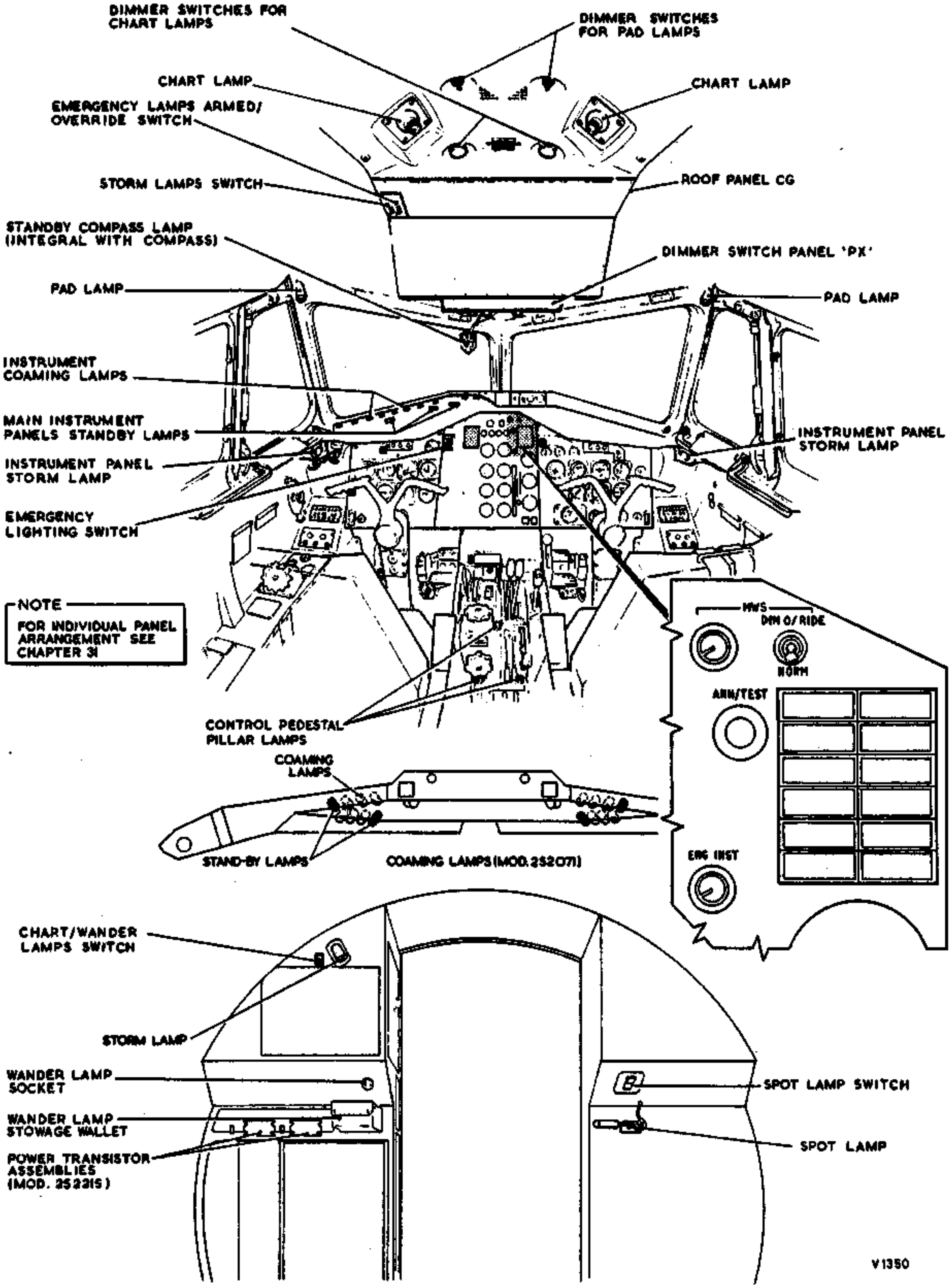
DIMMER SWITCHES FOR CHART LAMPS
DIMMER SWITCHES FOR PAD LAMPS
CHART LAMP
CHART LAMP
EMERGENCY LAMPS ARMED/ OVERRIDE SWITCH
STORM LAMPS SWITCH
ROOF PANEL CG
STANDBY COMPASS LAMP (INTEGRAL WITH COMPASS)
DIMMER SWITCH PANEL 'PX'
PAD LAMP
PAD LAMP
INSTRUMENT COAMING LAMPS
MAIN INSTRUMENT PANELS STANDBY LAMPS
INSTRUMENT PANEL STORM LAMP
INSTRUMENT PANEL STORM LAMP
EMERGENCY LIGHTING SWITCH
NOTE
FOR INDIVIDUAL PANEL ARRANGEMENT SEE CHAPTER 31
MWS
DIM O/RIDE
NORM
ANN/TEST
ENG INST
CONTROL PEDESTAL PILLAR LAMPS
COAMING LAMPS
STAND-BY LAMPS
COAMING LAMPS (MOD.252071)
CHART/WANDER LAMPS SWITCH
STORM LAMP
WANDER LAMP SOCKET
WANDER LAMP STOWAGE WALLET
POWER TRANSISTOR ASSEMBLIES (MOD. 252215)
SPOT LAMP SWITCH
SPOT LAMP
V1350

Flight compartment lighting
Fig.1

...Flight compartment lighting - Description and operation continued

### 3. Wander lamp

A wander lamp for inspection purposes is stowed in a wallet on the flight compartment bulkhead. A socket for the lamp is provided adjacent to the wallet; power supplies to the socket are controlled by the combined CHART LIGHT/WANDER LIGHT switch on the flight compartment right-hand bulkhead.

### 4. Spot lamp

A bulls-eye type spot lamp, with universal mounting, is fitted on the forward face of the compartment left-hand bulkhead. A control switch is mounted on the bulkhead, adjacent to the lamp.

### 5. Chart and pad lamps

Two chart lamps, one for each crew member, are mounted in the crew services panel with associated on-off dimmer switches and a switch on panel DA. Two lamps, mounted at the top of the left and right windshield pillars to illuminate the writing pads, are controlled by dimmer switches in the crew services panel.

### 6. Storm lamps

Three lamps are provided to give high intensity white light to prevent crew flash blindness during lightning conditions. The lamps, one on the flight compartment right-hand bulkhead and one above each side console, are controlled by a STORM switch on roof panel CG.

PS1

RED AND WHITE COAMING AND LOWER CANOPY RAIL LAMPS

STORM LAMPS

NAVIGATIONAL AIDS

XS1

ENGINE INSTRUMENT LIGHTING

PS2

RED AND WHITE COAMING AND LOWER CANOPY RAIL LAMPS

LEFT INSTRUMENT PANEL SPOT LAMP (IF FITTED)

PE

LEFT BULKHEAD SPOT LAMP

STANDBY COMPASS LIGHTING

MAIN INSTRUMENT PANEL WHITE EMERGENCY LAMPS (SEE PARA.8)

C.A.G.S. PANEL PILLAR LAMPS(S)

CONTROL PEDESTAL PILLAR LAMPS

WANDER LAMP SOCKET

CHART LAMPS

PAD LAMPS

ROOF PLASTECK PANELS

OXYGEN REGULATOR LIGHTING

Flight compartment lighting - power distribution
Fig.2

## 7. Standby lighting

Electrical power for standby lighting is available when the essential busbar PE is energized (see Chapter 24, GENERAL). The standby lamps are connected to busbar PE and are controlled by their normal switches.

## 8. Emergency lighting

An EMERG LTS switch, positioned on the main instrument centre panel CC, with a red surround, controls the supply voltage from PE busbar for white lamps mounted on the lower canopy rail for instrument panel lighting.

* * *

## DIMMER SWITCHES - MAINTENANCE PRACTICES

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1. Removal/Installation

A. Remove switch from dimmer switch panel

(1) Isolate relevant switch electrical circuit (Chapter 24, GENERAL).

(2) Unscrew grubscrew and remove knob.

(3) Remove panel-securing screws and withdraw panel sufficiently to allow access to the switch terminals.

(4) Remove nut securing switch to panel and withdraw switch from back of panel.

(5) Disconnect electrical cables at dimmer switch.

B. Install switch in dimmer switch panel

(1) Connect electrical cables to switch.

(2) Assemble switch to panel and secure with nut.

(3) Secure dimmer switch panel to airframe.

(4) Fit knob over shaft and secure with grubscrew.

(5) Restore switch electrical supplies.

(6) Functionally test relevant switch circuit.

C. Remove switch from control pedestal

(1) Isolate switch electrical circuit (Chapter 24, GENERAL).

(2) Unscrew grubscrew and remove knob.

(3) Release autopilot trim indicator panel studs and withdraw panel sufficiently to allow access to switch terminals.

(4) Disconnect electrical cables at switch.

(5) Remove bolts and lockwasher, and centre nut securing switch to the panel switch mounting bracket. Withdraw switch from bracket and panel.

D. Install switch on control pedestal

(1) Connect electrical cables to switch.

(2) Interpose nut between rear of switch mounting bracket and panel, insert switch

... **Dimmer Switches - Maintenace Practices continued**

spindle through rear of bracket, nut and panel.

(3) Secure switch to bracket with bolts and lockwashers. Tighten nut.

(4) Restore switch electrical supplies.

(5) Functionally test switch circuit.

* * *

## SPOT LAMP - MAINTENANCE PRACTICES

### 1. Removal/Installation

A. Remove lamp

(1) Isolate relevant lamp electrical circuit.

(2) Unscrew end cap from lamp.

(3) Remove filament.

(4) Unscrew lamp body from lampholder.

(5) Unscrew retaining ring of lampholder and remove lampholder.

(6) Disconnect electrical cables at lamp terminal block.

(7) Remove terminal block.

(8) Remove lamp.

B. Install lamp

(1) Secure lamp to bulkhead with countersunk screws.

(2) Insert electrical cables through hole in side of lamp bracket and connect to terminal block.

(3) Fit lampholder to lamp bracket and screw on retaining ring.

(4) Screw on lamp body.

(5) Fit filament.

(6) Screw on end cap.

(7) Restore relevant lamp electrical supplies.

(8) Functionally test circuit.

* * *

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# SIDEWALL STORM LAMP - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove lamp

(1) Isolate sidewall storm lamp electrical circuit (Chapter 24, GENERAL).

(2) Remove filament.

(3) Release the sidewall trim panel Camloc fasteners as necessary to enable access to the lampholder mounting bracket.

(4) Remove the lampholder mounting bracket securing bolt and washer.

(5) Withdraw lampholder mounting bracket, complete with lampholder and housing, and disconnect the electrical cables at the lampholder terminals.

(6) Remove lampholder locking nut and separate lampholder and housing from bracket.

### B. Install lamp

(1) Assemble lampholder to mounting bracket, fit lamp housing over lampholder, and secure the assembly with the locking nut.

(2) Connect and secure the electrical cables to the lampholder terminals.

(3) Locate the assembly to the bracket on the compartment sidewall and secure with the bolt and washer.

(4) Fit filament.

(5) Restore sidewall storm lamp electrical supplies (Chapter 24, GENERAL).

(6) Functionally test sidewall storm lamp.

(7) Engage Camloc fasteners to secure sidewall trim panel.

* * *

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## CENTRAL ATTENTION GETTING SYSTEM - DESCRIPTION AND OPERATION

### 1. Description

The Central Attention-getting System (c.a.g.s.) comprises a logic unit, two flasher units, two amber (FAIL) lamps and a flasher cancelling switch. The c.a.g.s. accepts signals from individual aircraft systems and utilizes them to activate the flasher units, which are free-running multivibrators. The outputs of the flasher units are applied to the amber (FAIL) lamps which are mounted on the instrument panel coaming within the pilots forward peripheral vision, causing them to operate at a rate of 2 to 3 flashes per second, to provide a central attention-getting display.

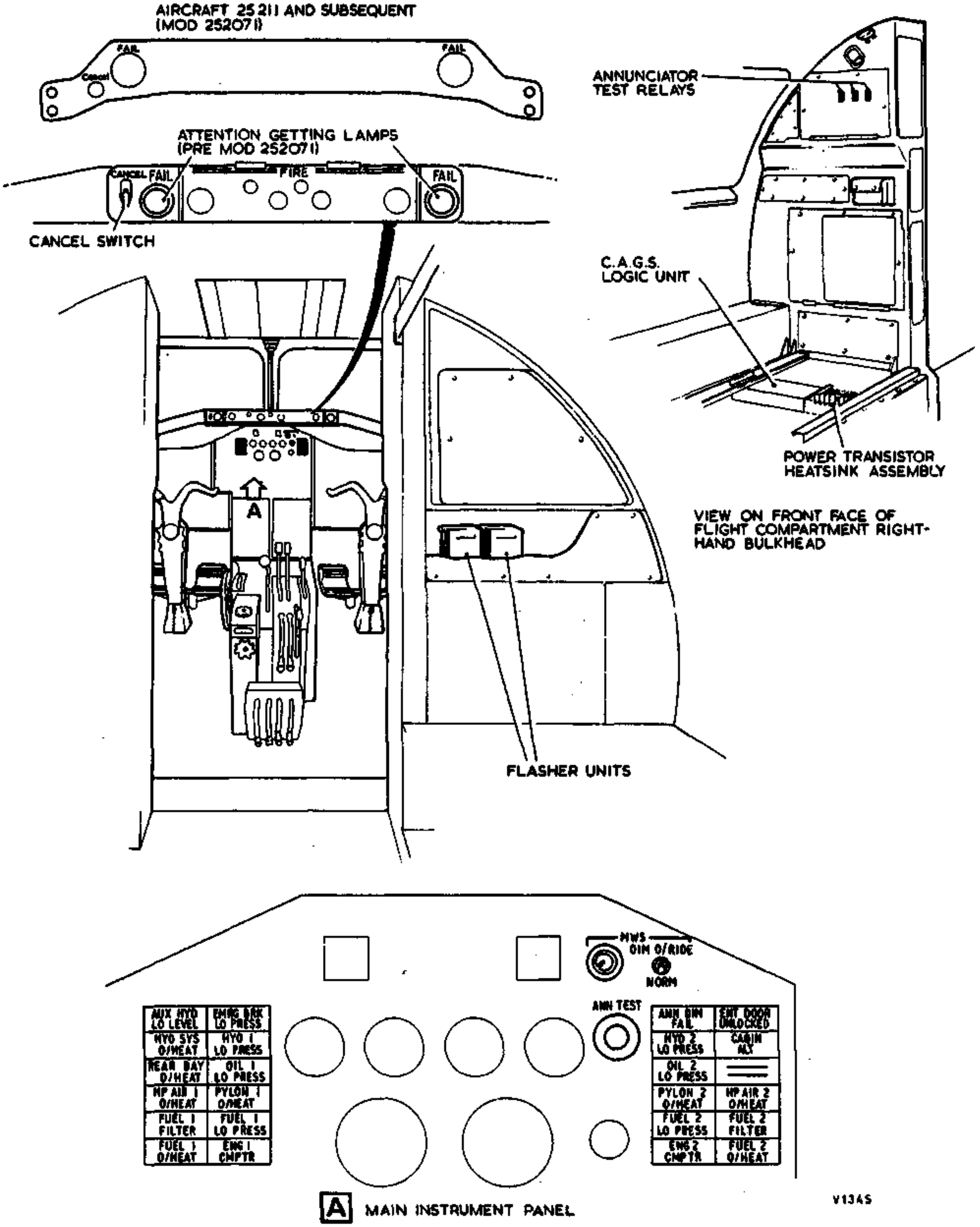
The systems fault signals applied to the c.a.g.s. (see Table 1) are also fed to individual warning lamps on the pilots roof panel and to annunciators on the centre instrument panel. Owing to the additional requirements imposed by the installation of TFE31 engines and limited space availability, the annunciators on the centre instrument panel are installed in two matrixes. Whereas existing individually located warning lamps have integral press-to-test facilities and dimmable mechanical irises, remote dimming control, testing and failure circuits are provided for the matrix annunciators.

The annunciator dimming and testing facility includes an ANN TEST push switch, a dimmer switch and a DIM O/RIDE-NORM switch, together with the dimming control and failure circuit located in the logic unit and an external power transistor. The power transistor is connected in the annunciators earth return circuit when the DIM O/RIDE-NORM switch is selected at NORM. An ANN DIM FAIL annunciator will light if the dimming control circuit fails.

The level of annunciator illumination is determined by the dimmer switch and the dimming function is effective when the system CANCEL switch has been operated following receipt of a warning. Each warning signal input causes its associated annunciator to light at maximum brilliance and also causes existing but cancelled warnings to "bright-up".

If a warning input is applied but the individual annunciator fails to light, owing to failure of the dimming circuit, the ANN DIM FAIL annunciator will light at maximum brilliance and the FAIL lamps will flash. If the DIM O/RIDE-NORM switch is selected to O/RIDE, the dimming control circuit is by-passed, the warning is presented at maximum brilliance and the ANN DIM FAIL annunciator is extinguished. If the CANCEL switch is operated in this situation, the flashing FAIL lamps are cancelled but the warnings remain illuminated at maximum brilliance. The ANN TEST switch, when pressed, checks the dimming control and failure circuit and causes all annunciators in the matrixes to illuminate. This is achieved directly from the busbars to the annunciators via the test switch or indirectly, as in the case of the rear bay overheat and pylon overheat annunciators, via relay switching circuits.

The c.a.g.s. input circuits, triggers, relays and the dimming control and failure circuits are accommodated on two printed circuit boards (p.c.b.) in the logic unit which is located with the power transistor and heat sink assembly beneath the co-pilots seat. The flasher units and test circuit relays are located in panel DA.



Central attention getting system
Fig.1

## TABLE 1

Inputs to c.a.g.s.

| Input | System lamp/annunciator | | Location |
|---|---|---|---|
| | Caption | Colour | |
| 1 | GENerator 1 FAIL | Amber | Roof panel |
| 2 | GENerator 2 FAIL | Amber | " " |
| 3 | XS1 bus FAIL | Amber | " " |
| 4 | XE bus FAIL | Red | " " |
| 5 | FIRE warning 1 | Red | " " |
| 6 | FUEL 2 Low PRESSure | Amber | Centre panel |
| 7 | FUEL 1 Low PRESSure | Amber | " " |
| 8 | OIL 1 Low PRESSure | Red | " " |
| 9 | OIL 2 Low PRESSure | Red | " " |
| 10 | ICE WARNing | Amber | Roof panel |
| 11 | BUS TIE open | Amber | " " |
| 12 | HP AIR 1 OHEAT | Red | Centre panel |
| 13 | W/SCREEN HEAT FAIL | Amber | Roof panel |
| 14 | HP AIR 2 OHEAT | Red | Centre panel |
| 15 | FIRE warning 2 | Red | Roof panel |
| 16 | REAR BAY OHEAT | Red | Centre panel |
| 17 | Res. | | |
| 18 | XS2 bus FAIL | Amber | Roof panel |
| 19 | ENGine 1 COMPuter | Amber | Centre panel |
| 20 | ENGine 2 COMPuter | Amber | " " |
| 21 | Spare | | |
| 22 | PYLON 1 OHEAT | Red | " " |
| 23 | PYLON 2 OHEAT | Red | " " |
| 24 | FUEL 1 FILTER | Amber | " " |
| 25 | FUEL 2 FILTER | Amber | " " |
| 26 | FUEL 1 OHEAT | Amber | " " |
| 27 | FUEL 2 OHEAT | Amber | " " |
| 28 | Spare | | |
| 29 | Spare | | |
| 30 | Spare | | |

## 2. Operation

A fault signal deriving in a system associated with the c.a.g.s. is applied simultaneously to its individual system warning lamp/annunciator and to the logic unit. Within the logic unit the signal is fed via capacitors to the bases of two transistors, each of which is in the negative return circuit of a relay. The transistors turn on to energize the relays, the contacts of which close to energize relay hold-on coils, activate the flasher units and cause the related annunciator and any previously lit, but cancelled, annunciators to illuminate at full brilliance. The outputs of the flasher units cause the FAIL lamps to flash.

When the fault input capacitors are charged up, current to the transistor bases is inhibited and the transistors turn off to de-energize the relays operating coils. Busbar input to the relay hold-on coils, flasher units and the dimming control "bright-up" circuit is maintained, however, via the relays contacts and the CANCEL switch. Operating the CANCEL switch breaks the relays hold-on coils circuit, thereby inhibiting the flashing FAIL lamps and causing the annunciators to return to their previous level of illumination; thus, the system is reset to respond to subsequent fault inputs.

* * *

## CENTRAL ATTENTION GETTING SYSTEM - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Test c.a.g.s.

(1) Set BATTERY switch ON.

(2) Check that the coaming amber FAIL lamps are flashing and that the matrix annunciators are brightly illuminated.

(3) Operate the CANCEL switch and check that the flashing FAIL lamps are inhibited and the matrix annunciators dim.

(4) Operate the dimming potentiometer and observe that the level of illumination increases or decreases accordingly.

(5) Depress ANN TEST switch and check that all matrix annunciators "bright-up". Release switch and observe that the matrix annunciators dim.

(6) Operate DIM O/RIDE-NORM switch to O/RIDE and observe increase in brightness of matrix annunciators.

(7) Set DIM O/RIDE-NORM switch to NORM and observe decrease in annunciators illumination.

(8) Set BATTery switch "off" and check that all annunciators are extinguished.

(9) Set BATTery switch ON and check that the amber FAIL lamps flash and the matrix annunciators are "brightly" illuminated.

(10) Set BATTery switch "off".

* * *

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# PASSENGER COMPARTMENT LIGHTING - DESCRIPTION

## 1. General

For location of the lamps and switches, refer to Fig.1, for details of the power supplies, refer to Fig.2.

## 2. Passenger and toilet compartment lighting

### A. General lighting

Passenger compartment general lighting is provided by fluorescent lamps mounted in the left and right passenger service units. Two separate circuits provide power supplies to the lamps, from a common busbar. Access to the lamps, and their associated wiring, is by hanging part of the passenger service unit downward. Inverter/ballast units which convert the aircraft 28 V d.c. supply to single phase a.c. supply, necessary for fluorescent lamp operation, are fitted in the compartment roof, above the roof trim panels. Control of passenger compartment lighting is effected by two switches, a CABIN MAIN switch on roof panel CG, and a CABIN LIGHTS switch on the galley switch panel FG-A.

On the ground (mod.25/6249) additional control of compartment lighting is provided by the ROOF LIGHT or ENTRY LIGHT switches (see Vestibule lighting). Selection of either switch to 'on' will connect a supply direct from No.1 battery via the right main gear oleo microswitch, to energize a relay on panel DA. When the relay contacts changeover, a supply direct from No.1 battery is connected to the CABIN LIGHTS switch on the galley switch panel FG-A. Operating the CABIN LIGHTS switch will light the compartment alternate roof fluorescent lamps on the left and right sides. When a landing gear 'weight off' condition (airborne) occurs the microswitch contacts changeover and de-energize the circuit relay. The relay contacts in the relaxed position disconnect No.1 battery supply and connect PS2 busbar supply to passenger compartment lighting, and circuit control reverts to the roof panel CG CABIN MAIN light switch.

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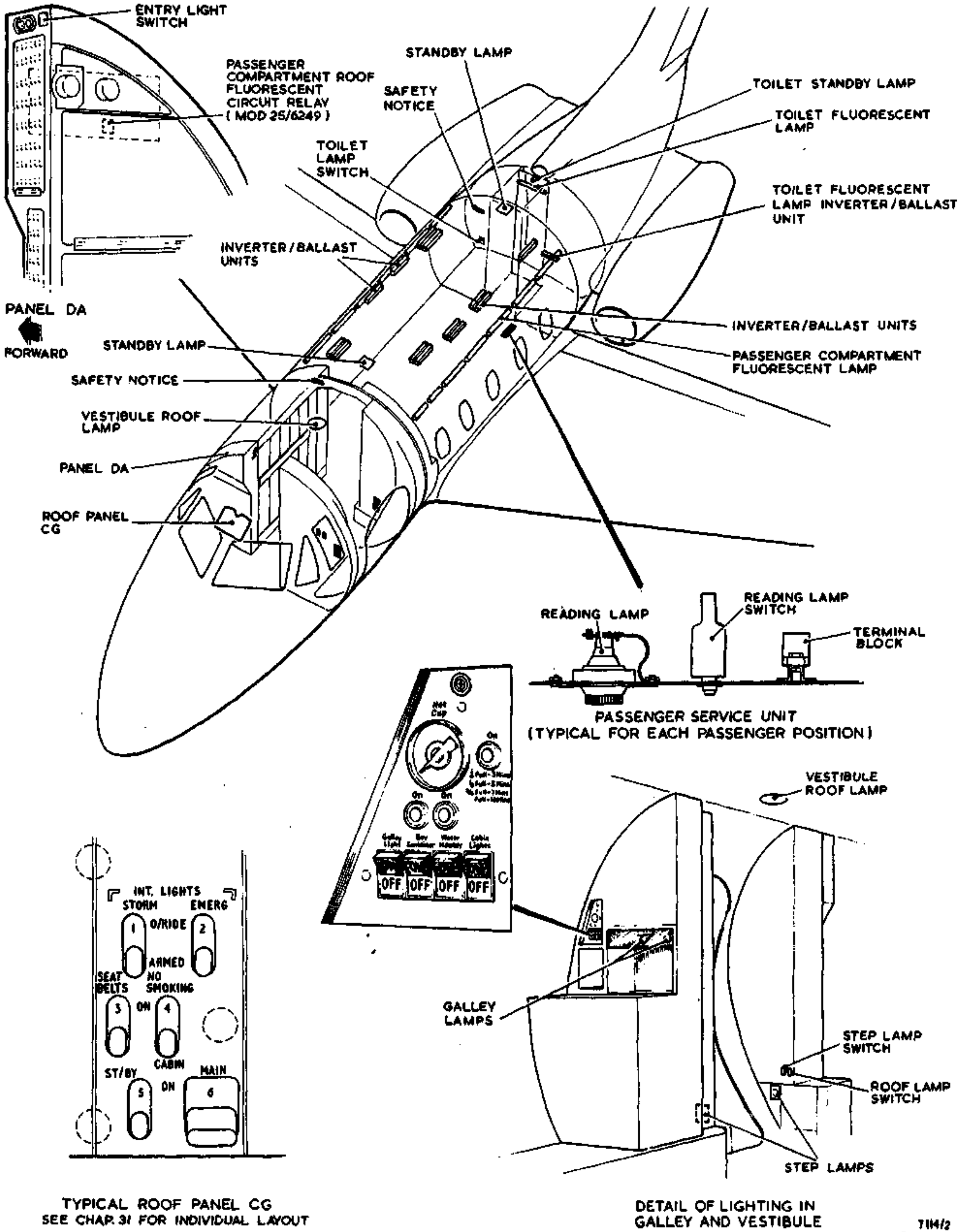
### B. Reading lamps

An individual reading lamp and push-button switch is fitted in the passenger service unit, above each passenger position.

### C. Toilet compartment lighting

The toilet compartment fluorescent lamp and standby lamp are both mounted in the toilet console, above the mirror unit. The inverter/ballast unit for the fluorescent lamp is mounted in an equipment stowage in the left-hand of the console.

Control of the toilet lamp is by a switch mounted on the passenger compartment rear right-hand bulkhead.



PASSENGER SERVICE UNIT
(TYPICAL FOR EACH PASSENGER POSITION)

TYPICAL ROOF PANEL CG
SEE CHAP. 31 FOR INDIVIDUAL LAYOUT

DETAIL OF LIGHTING IN
GALLEY AND VESTIBULE

Typical passenger compartment lighting
Fig.1

...Passenger compartment lighting - Description continued

D. Passenger safety notices

Two safety notices are fitted, one on the passenger compartment right-hand front bulkhead and the other on the right-hand rear bulkhead. These notices, labelled FASTEN BELTS and NO SMOKING, are illuminated internally by lamps controlled from switches on the pilots' roof panel.

E. Standby lamps

Two standby lamps are fitted in the passenger compartment roof, and another is installed in the toilet compartment. All three lamps are controlled by a switch on the pilots' roof panel.

F. Vestibule lighting

Entrance illumination is provided by step lamps and a roof mounted lamp assembly. The roof lamp assembly consists of two lamps, one lamp being utilized for normal lighting, and the second lamp for EMERGENCY LIGHTING. Control of the normal roof lamp is effected by two control switches, an ENTRY LIGHT switch mounted on the inboard edge of panel DA and a ROOF LIGHT switch on the rear face of the vestibule forward cabinet. Both switches are wired to form a two-way switching circuit, to enable effective control of entrance illumination during aircraft entry or exit. Power supply to the normal roof lamp is direct from No.1 battery, so that a supply voltage is available to the lamp control swithces regardless of the aircraft BATTery switch position.

A step lamp is located on either side of the entry door, mounted on facing bulkheads, with the lamp's beam directed onto the entry door steps. A STEP LIGHT control switch is positioned alongside the ROOF LIGHT switch on the rear face of the vestibule forward cabinet.

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PS1

PASSENGER COMPARTMENT READING LAMPS

CABIN SAFETY NOTICES

PS2

PASSENGER AND TOILET COMPARTMENT FLUORESCENT LAMPS

GALLEY WORKTOP LAMPS

PE

VESTIBULE STEP LAMP(S)

PASSENGER AND TOILET COMPARTMENT STANDBY LAMPS

BATTERY SUPPLY

ROOF LAMP

VESTIBULE STEP LAMP (MOD.256249)

PASSENGER COMPARTMENT FLUORESCENT LAMPS (MOD 256249 : GROUND CONDITIONS)

Power supplies
Fig.2

...Passenger compartment lighting - Description continued

## G. Galley and wardrobe lighting

Galley illumination is provided by a lamp assembly fitted over the galley work top, and controlled by a GALLEY LIGHT switch on the galley switch panel. Optional fitting includes a wardrobe interior lamp assembly, which is illumiated by either a wardrobe door operated microswitch or a control switch fitted on the wardrobe.

* * *

## FLUORESCENT LAMPS - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove lamp

(1) Isolate passenger reading lamps and compartment lighting electrical circuit (see Chapter 24, GENERAL).

(2) Remove passenger service unit (p.s.u.) trim panel(s), (see Chapter 25, PASSENGER COMPARTMENT AND VESTIBULE).

(3) Remove the fluorescent lamp.

#### B. Install lamp

(1) Locate fluorescent lamp in lampholders and spring clips.

(2) Restore passenger reading lamps and compartment lighting electrical circuit.

(3) Functionally test passenger reading lamps and compartment lighting.

(4) Raise and secure p.s.u. assembly, and refit trim panels.

* * *

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# PASSENGER COMPARTMENT AND TOILET STANDBY LAMPS - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove passenger compartment lampholder

NOTE : ✝ These items are attached by Velcro Strip.

(1) Isolate lamp electrical circuit (see Chapter 24, GENERAL)

(2) Remove the passenger compartment roof centre trim. ✝

(3) Remove standby lamp cover. ✝

(4) Remove the terminal block access trim, ✝ and disconnect lamp electrical cables at roof mounted terminal block.

(5) Release 'P' clip screw securing lamp cable loom.

(6) Remove the filament lamp.

(7) Remove bolts, spring washers and nuts securing lampholder assembly and remove complete with cable assembly.

### B. Install passenger compartment lampholder

(1) Locate lampholder assembly and secure with screws, nuts and spring washers.

(2) Route lamp electrical cables to terminal block, connect and secure. Tighten 'P' clip screws securing cable loom and ensure that grommet is seated correctly.

(3) Fit filament lamp.

(4) Restore electrical supplies.

(5) Functionally test standby lighting circuit.

(6) Secure terminal block access trim to soundproofing structure with Velcro Strip.

(7) Secure standby lamp cover to centre trim panel with Velcro Strip.

(8) Secure passenger compartment roof centre trim panel to soundproofing structure with Velcro Strip.

### C. Remove toilet lamp

(1) Isolate lamp electrical circuit.

(2) Remove bolt and washer securing lamp assembly cover and withdraw cover.

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... Passenger compartment and toilet standby lamps - Maintenance practices continued

(3) Remove filament lamp, also fluorescent tube to facilitate access to standby lampholder securing attachments.

(4) Disconnect lamp cables at terminal block and release 'P' clip screw securing lamp cable loom.

(5) Remove nuts, screws and washers securing lampholder assembly and withdraw complete with cable assembly.

D. Install toilet lamp

(1) Locate lampholder assembly on reflector plate, and secure with nuts, screws and washers.

(2) Route lamp cables to terminal block, connect and secure. Tighten cable loom 'P' clip screw and check that the cable run grommets are seated correctly.

(3) Fit filament lamp and fluorescent tube.

(4) Secure toilet lamp assembly cover with bolts and washers.

(5) Functionally test toilet fluorescent tube and standby lamp circuits.

* * *

# CABIN SAFETY NOTICES - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove bulkhead safety notice

(1) Isolate safety notice electrical circuit (see Chapter 24, GENERAL).

(2) Gain access to bulkhead safety notice overhead plug break and disconnect connector.

(3) At rear bulkhead, release access door fastener or remove forward bulkhead notice cover.

(4) Gain entry to safety notice through cut-out access panel or open hinged door and remove cable and safety notice assembly.

CAUTION : DURING FILAMENT LAMP REPLACEMENT USE ONLY THE CORRECT SIZE FILAMENT TO AVOID NOTICE OVERHEATING AND POSSIBLE FIRE HAZARD

### B. Install bulkhead safety notice

(1) Position safety notice in bulkhead cut-out, route cable assembly to overhead connector bracket, and connect connector at plug break.

(2) On rear bulkhead, secure access door fastener, or fit forward bulkhead notice cover.

(3) Replace bulkhead trim access panels as required.

(4) Restore electrical circuit.

(5) Functionally test safety notice circuit.

* * *

# PASSENGER READING LAMP AND SWITCH - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove passenger reading lamp

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Remove the passenger service unit (p.s.u.) trim panels, release p.s.u. securing attachments and lower p.s.u. assembly (see Chapter 25, PASSENGER COMPARTMENT AND VESTIBULE).

(3) Remove screws, nuts and washers securing the passenger service unit.

(4) Disconnect the lamp electrical cables at the terminal block.

(5) Remove lamp from passenger service unit.

### B. Install passenger reading lamp

(1) Locate reading lamp in p.s.u. cut-out, and secure with screws, nuts and washers.

(2) Connect and secure the lamp electrical cables to the terminal block.

(3) Restore relevant electrical circuit.

(4) Functionally test reading lamp and compartment lighting.

(5) Raise and secure p.s.u. assembly, and refit trim panels.

### C. Remove switch

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Remove p.s.u. trim panels, release p.s.u. securing attachments and lower p.s.u. assembly (see Chapter 25, PASSENGER COMPARTMENT AND VESTIBULE).

(3) Disconnect the switch electrical cables at the terminal block.

(4) Remove switch locknut and remove switch from p.s.u.

### D. Install switch

(1) Locate switch in p.s.u. cut-out and secure with locknut.

(2) Connect and secure switch electrical cables to the terminal block.

(3) Restore relevant electrical circuit.

(4) Functionally test passenger reading lamp and compartment lighting.

(5) Raise and secure p.s.u. assembly and refit trim panels.

* * *

## REAR EQUIPMENT BAY LIGHTING - DESCRIPTION

A lamp and socket is provided in the roof of the rear equipment bay to provide general area lighting and power supply for a plug in wander lamp.

Electrical 28V. d.c. supply to both the lamp and power point socket is taken from busbar PE via an on/off switch on the structure adjacent to the bay door hinge.

Control of the switch is by manual selection to 'on' or 'off' and automatic selection to 'off' when the door is closed.

The lamp body incorporates a filament, power point socket and a bar type on/off switch. The bar switch is wired in series with the main on/off switch and controls supplies to both the lamp and socket. During normal operation, the bar switch is left in the 'on' position.

* * *

## REAR EQUIPMENT BAY LIGHTING - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Functionally test bay lighting and check switch alignment

(1) With rear equipment bay door closed and secured, check from inside the rear equipment bay that the switch is not under strain.

(2) If necessary, loosen striker arm slotted hole stiffnut and bolt sufficiently to adjust striker arm to achieve optimum setting. Tighten *bolt and stiffnut.*

(3) Energize PE busbar (see Chapter 24, GENERAL).

(4) With rear equipment bay door open, manually select switch to on, and check bay lamp comes on. Close bay door and check that lamp goes out.

(5) De-energize busbar.

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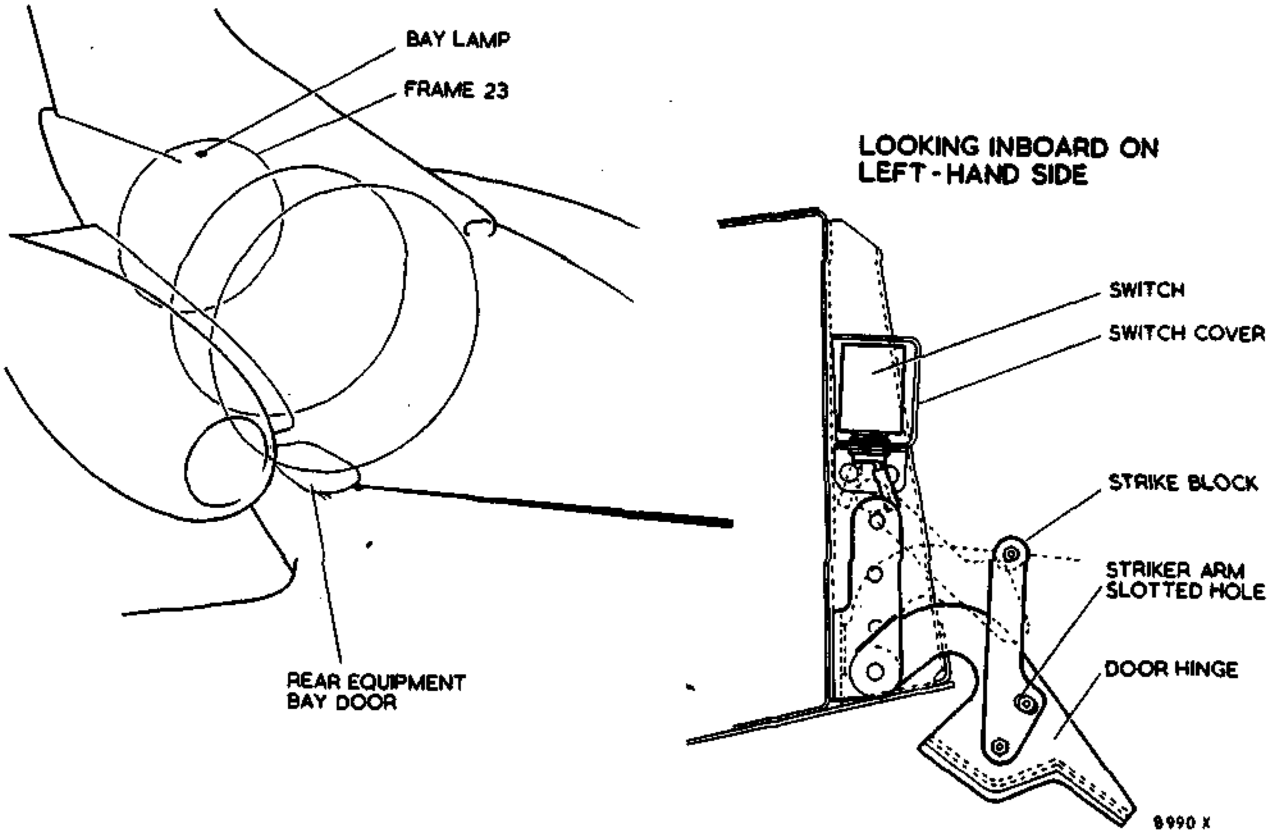

Switch adjustment
Fig.201

* * *

## EXTERIOR LIGHTING - DESCRIPTION AND OPERATION

### 1. General

Location of exterior lamps is shown on Fig.1. All lamps are controlled by toggle switches on roof panel CG; the power supply arrangement is as shown on Fig.2.

### 2. Navigation lamps

These lamps give a high-intensity red (left wing-tip), green (right wing-tip) and clear (tailplane) light. All three lamps are controlled by a single switch labelled NAV.

### 3. Landing and taxiing lamps

Mounted side-by-side in each wing, these lamps are sealed-beam units controlled by individual switches labelled LANDING and TAXI.

When the 450 watt landing lamps introduced by Mod.255789 Pt.B are fitted, they must only be used in flight, or only briefly on the ground to check functioning unless the transparent panel is removed.

### 4. Anti-collision beacons

These provide a flashing beam of red light. Each beacon contains two reflector filaments mounted in tandem on oscillating platforms. Both beacons are controlled by a single switch labelled BEACON. Provision for a moisture drain is provided by the lens cover retaining bolt setscrew; when the beacon is fitted in the lower (inverted) position the setscrew is removed. On aircraft with Mod.252223 embodied, additional drainage for the lower beacon includes drain holes in the lens cover forward and aft of the attachment bosses.

### 5. Wing ice-inspection spotlamp

This lamp is controlled by a switch labelled WING; an additional lamp to illuminate the right wing leading edge is fitted to special order.

### 6. Strobe lighting

To special order only, provision for high intensity strobe lighting includes wiring out to each wing tip leading edge, to allow fitting of strobe lights adjacent to the navigation lamps.

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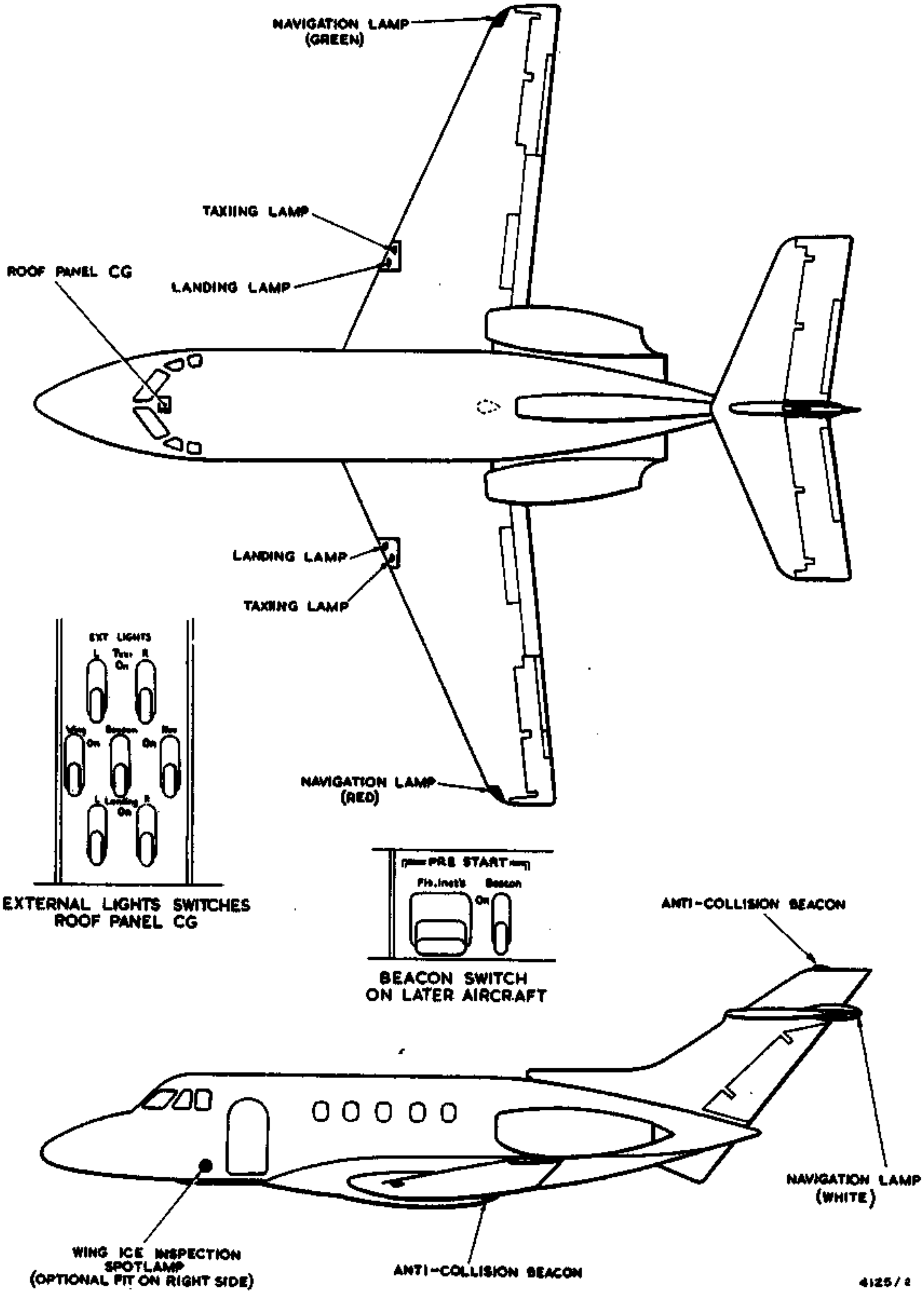
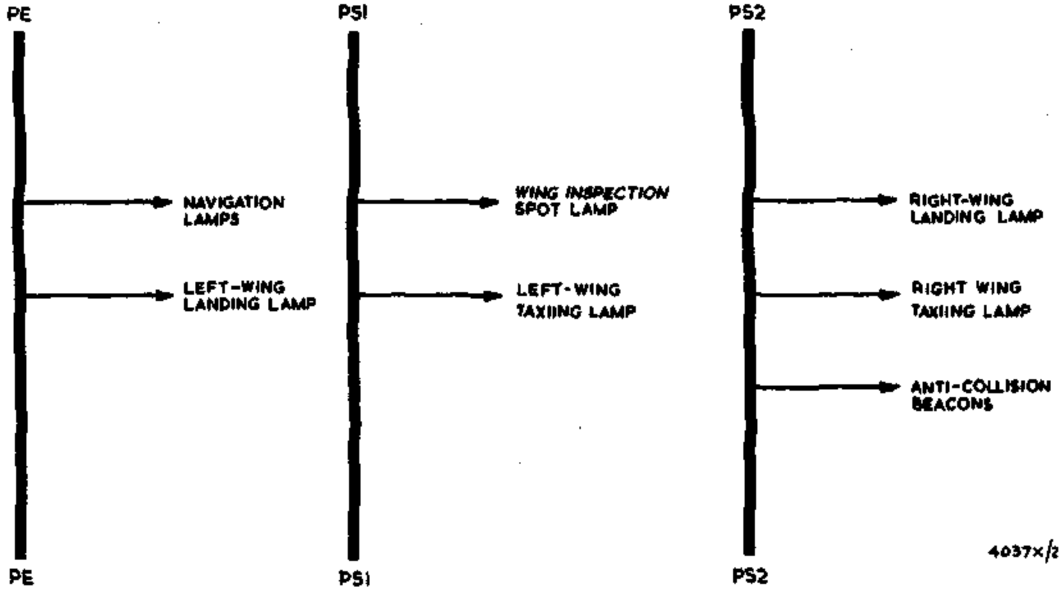
continued.....



Exterior lighting
Fig.1



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Exterior lighting - power distribution
Fig. 2

* * *

# TAIL NAVIGATION LAMP - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove lamp

(1) Isolate relevant electrical circuit (see Chapter 24, GENERAL).

(2) Release Dzus fasteners securing lamp shield and lens and remove shield and lens complete with gasket.

(3) Unscrew exposed lamp securing screws and withdraw lamp sufficiently to allow access to the lamp terminal block.

(4) Remove terminal block cover and disconnect electrical cables.

(5) Remove lamp and refit shield and lens.

### B. Install lamp

(1) If a new lamp is being fitted, first remove lamp shield and lens, and remove terminal block cover.

(2) Connect electrical cable to terminal block.

(3) Refit terminal block cover.

(4) Secure lamp to airframe, and check that bonding is in good condition. Renew as necessary.

NOTE : Bonding is effected by forming a U-loop of aluminium scotch foil over the rubber gasket at the lamp housing securing screws. When fitting a new lamp assembly remove protective finish locally between mating surfaces to effect a good bond.

(5) Restore lamp electrical circuit.

(6) Energize busbar PE (see Chapter 24, GENERAL).

(7) Functionally test navigation lamp.

(8) De-energize busbar PE.

(9) Assemble lens, complete with gasket and shield to lamp, and secure with Dzus fasteners.

* * *

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# LANDING AND TAXIING LAMPS - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove lamp

(1) Isolate relevant lamp electrical circuit (see Chapter 24, GENERAL)

(2) Remove transparent panel and retaining strip.

(3) Remove locknuts and bolts securing lamp to adjustment brackets and withdraw lamp sufficiently to allow disconnection of the cables at the lamp terminals.

(4) Disconnect electrical cables.

(5) Unscrew bezel ring clamping screws and remove rings and sealing strip.

### B. Install lamp

(1) With lamp filament shield located inboard, assemble bezel ring and sealing strip to lamp, and secure with clamping screws.

(2) Offer up lamp to mounting bracket and connect electrical cables to lamp terminals.

(3) Secure lamp to adjustment brackets with bolts and locknuts.

(4) Restore relevant lamp electrical circuit.

(5) Functionally test lamp circuit and adjust beam if necessary.

(6) Refit transparent panel and retaining strip.

## 2. Adjustment/Test

### A. Adjust lamp (Fig. 201)

(1) Jack and level aircraft (see Chapters 7 and 8).

NOTE : For this adjustment it is essential that the area in which it takes place is completely level.

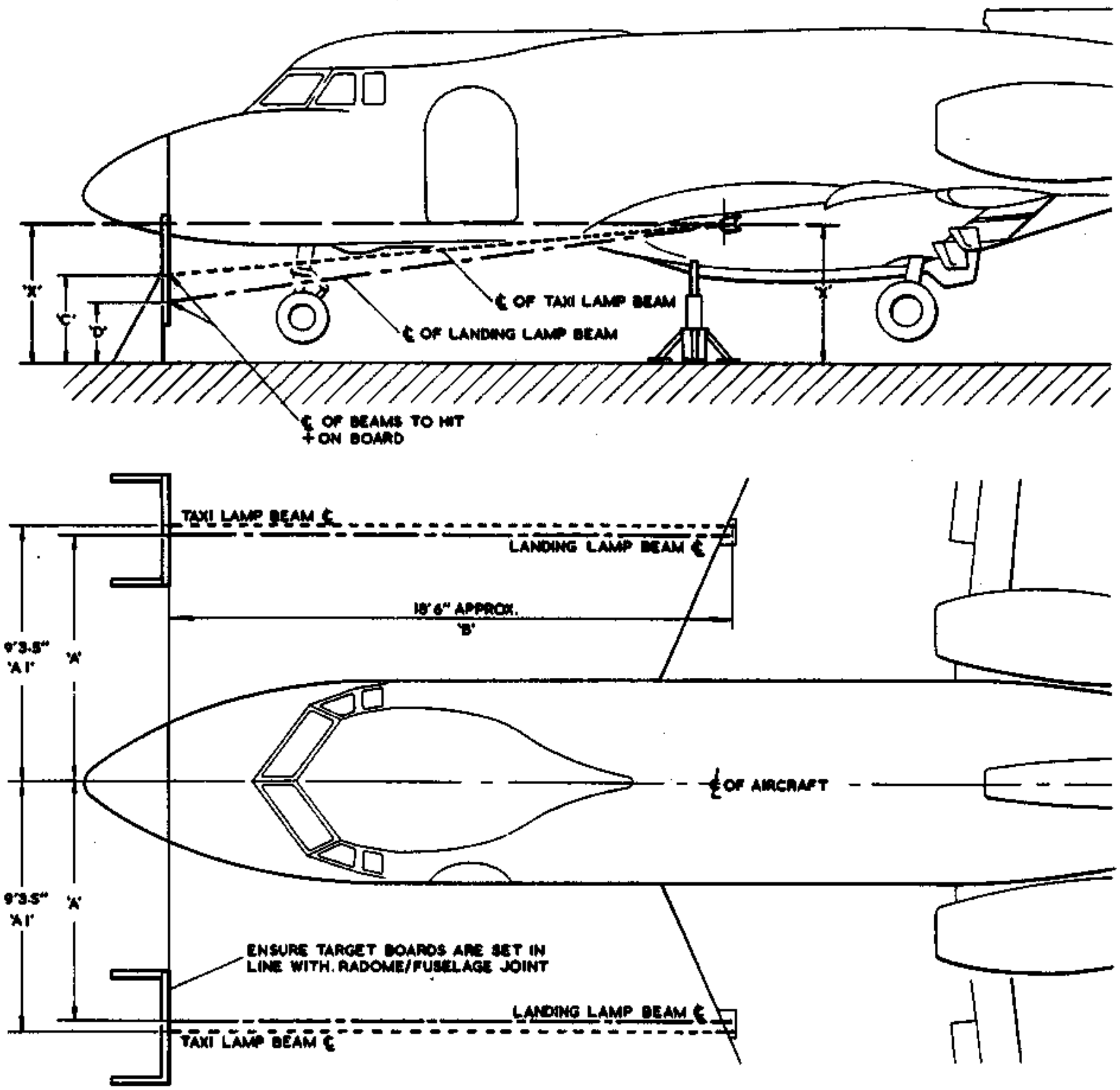
(2) Arrange target boards in front of each lamp group as shown, ensuring that boards are vertical and in line with each other on a line normal to the aircraft centre line.

(3) Remove transparent panel over each lamp group.

(4) Slacken nuts securing adjustment brackets to mounting brackets.

(5) Switch on relevant lamp switch.

(6) Adjust lamp until centre spot of beam is correctly positioned on target board.



| CODE | AIRCRAFT ON JACKS | CODE | AIRCRAFT ON GROUND |
|---|---|---|---|
| 'A' | DISTANCE FROM LANDING LAMP BEAM CENTRE LINE ON TARGET BOARD TO AIRCRAFT CENTRE LINE. | 'A' | AS FOR AIRCRAFT ON JACKS (LANDING). |
| 'A1' | DISTANCE FROM TAXI LAMP BEAM CENTRE LINE ON TRACK BOARD TO AIRCRAFT CENTRE LINE. | 'A1' | AS FOR AIRCRAFT ON JACKS (TAXI). |
| 'B' | DISTANCE FROM LAMP CENTRE LINE TO TRACK BOARD CENTRE LINE. | 'B' | AS FOR AIRCRAFT ON JACKS. |
| 'C' | ASCERTAIN DISTANCE X FROM CENTRE LINE OF LAMP TO GROUND, AND TRANSFER MEASUREMENT TO BOARD.<br>DISTANCE C EQUALS X MINUS 3".50 | 'C' | AS FOR AIRCRAFT ON JACKS EXCEPT FOR :-<br>DISTANCE C EQUALS X MINUS 7".75 |
| 'D' | MEASUREMENT OF HEIGHT AS FOR C EXCEPT DISTANCE D EQUALS X MINUS 19".0 | 'D' | AS FOR AIRCRAFT ON JACKS EXCEPT DISTANCE D = X MINUS 23".3 |

3071/2

Landing/Taxi lamps beam setting
Fig.201

...Landing and taxiing lamps - Maintenance practices continued

NOTE : (1) Adjustment is provided in vertical plane only (Fig. 202)
(2) Lamps should remain switched on for minimum period necessary to check adjustment.

(7) Switch off relevant lamp switch.

(8) Tighten nuts securing adjustment brackets to mounting brackets.

(9) Repeat items (4) to (8) for other lamps as required.

(10) Lower aircraft onto its wheels (Chapter 7).

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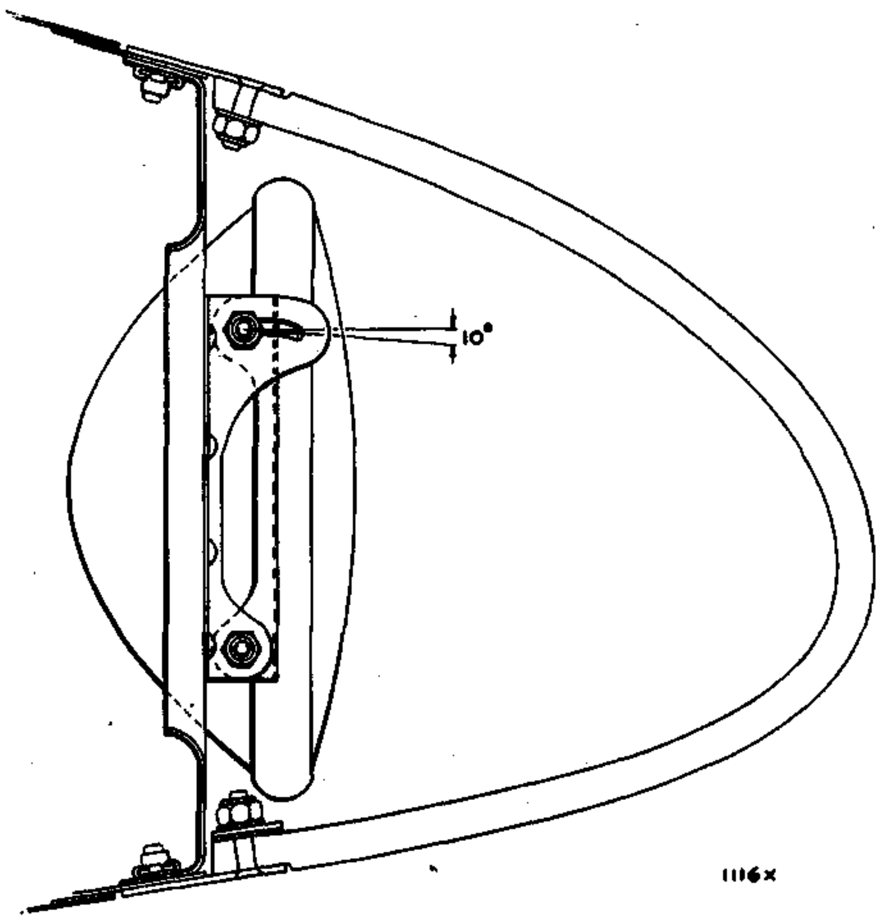

Landing and taxiing lamp adjustment
Fig. 202

(11) Refit transparent panels over each lamp group.

(12) Remove jacking equipment and target boards.

* * *

## ANTI-COLLISION BEACON - MAINTENANCE PRACTICES

### 1.Unit servicing

### A.Renew filament

(1) Isolate BEACON circuit (Chapter 24, GENERAL).

(2) Loosen the lens retaining clip screw. Unscrew the lens retaining screw and withdraw the lens from the retaining clip.

(3) Note the position of the open face of the filaments.

(4) Depress the filament gently in the socket until the indexing pins come into contact with the bottom of the 'J' slot. Rotate filament in an anti-clockwise direction (approx. 30 deg.) and remove filament from socket.

CAUTION : EXTREME CARE MUST BE TAKEN WHEN ROTATING THE FILAMENT IN ITS SOCKET. EXCESSIVE PRESSURE, OR AN ATTEMPT TO ROTATE THE FILAMENT BEYOND THE TRAVEL PERMITTED BY THE 'J' SLOT WILL RESULT IN STRIPPING OF THE BEACON FIBRE GEAR TEETH.

IF CORROSION HAS CAUSED THE FILAMENT TO SEIZE IN ITS SOCKET, THE COMPLETE BEACON MUST BE REMOVED FOR RECTIFICATION.

(5) Note the position of tilt in the sockets. Each socket has a deep 'J' slot on the high side.

(6) Fit a new filament.

NOTE : Ensure that the open face of the filament and the lower indexing pin directly below it, are placed into the high side of the socket. This side has the deepest 'J' slot.

(7) Ensure the faces of the filaments are 180 deg. opposed when fitted.

(8) Check gasket for deterioration or damage and renew if necessary.

(9) On lower beacon, ensure moisture hole(s) are not obstructed.

(10) Locate lens in retaining clip and secure with lens retaining screw. Tighten lens retaining clip screw.

(11) Restore BEACON circuit.

(12) Functionally test anti-collision beacon (para.3.).

## 2. Removal/Installation

### A. Remove beacon

(1) Isolate BEACON circuit (Chapter 24, GENERAL).

(2) Remove screw securing the lens retaining clip at rear of lens. Collect lens retaining clip.

(3) Unscrew the lens retaining screw and remove the lens.

(4) Remove the four bolts inside the beacon gasket area.

(5) Withdraw beacon from airframe sufficiently to allow disconnection of plug-and-socket connection.

(6) Disconnect plug and socket connection.

(7) Remove beacon complete with adapter plate.

### B. Install beacon

NOTE : If beacon is to be fitted in lower position, ensure that the drain screw is removed. If beacon is to be fitted in the upper position ensure that the drain screw is fitted and that the electrical socket is in the forward facing position.

(1) Ensure that Thiokol seal at face of adapter plate is not damaged or deteriorated; renew as necessary to a nominal thickness of 0.06 in. (see Chapter 20).

(2) Connect and secure plug-and-socket connection.

(3) Locate beacon and adapter plate to airframe and secure with four bolts.

(4) Check lens gasket for damage or deterioration and renew as necessary.

(5) On lower beacon only, ensure moisture drain hole(s) are not obstructed.

(6) Fit lens to beacon and secure with lens retaining screw.

(7) Fit lens retaining clip and secure with screw.

(8) Restore BEACON circuit.

(9) Functionally test anti-collision beacon (para.3.).

## 3. Adjustment/Test

### A. Functionally test anti-collision beacon

(1) Energize d.c. busbars (Chapter 24, GENERAL).

(2) Set BEACON switch ON, and check that each reflector filament oscillates through an arc of 180 deg. approximately, and that the light beams are about 180 deg. apart.

(3) Select BEACON switch off, and check that beacon operation ceases.

(4) De-energize busbar.

* * *

## WING ICE INSPECTION SPOTLAMP - MAINTENANCE PRACTICES

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### 1. Removal/Installation

#### A. Remove lamp

(1) Isolate lamp electrical circuit (Chapter 24, GENERAL).

(2) Remove panel surrounds and transparent panel.

(3) Remove filament.

(4) Remove nuts and bolts securing lampholder mounting bracket.

(5) Unscrew lampholder retaining ring and withdraw lampholder from bracket.

(6) Disconnect electrical cables at lampholder.

#### B. Install lamp

(1) Connect electrical cables to lampholder.

(2) Assemble lampholder to mounting bracket and secure with retaining ring.

(3) Secure mounting bracket to airframe.

(4) Fit filament.

**WARNING:** THE CORRECT SIZE FILAMENT MUST BE FITTED; AN INCORRECT SIZE FILAMENT MAY DAMAGE THE TRANSPARENT PANEL.

(5) Restore lamp electrical supplies (Chapter 24, GENERAL).

(6) Functionally test circuit.

(7) Fit countersunk screws and secure transparent panel and surrounds to fuselage.

* * *

## EMERGENCY LIGHTING - DESCRIPTION AND OPERATION
## (Mod. 251335 and 251721)

### 1. Description

Emergency lighting is provided by one lamp of a twin lamp assembly mounted on the vestibule roof. An additional lamp can be fitted to special order in the passenger compartment roof, to illuminate the escape hatch.

The lamp(s) are supplied from busbar PE or No.3 battery, and are controlled automatically by an inertia switch or manually depending on the setting of a switch labelled OVERRIDE/ARMED on roof panel CG. The piston type inertia switch is located in the nose left hand top deck, and is pre-set to operate at an aircraft deceleration of 1.5 ± 0.15G.

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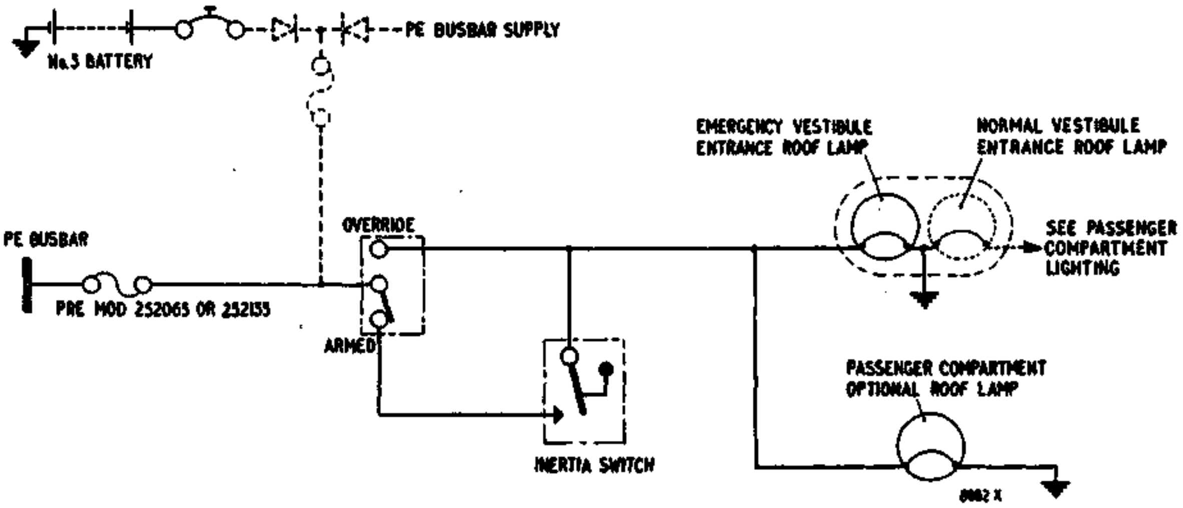
### 2. Operation

With the switch selected to ARMED, the electrical power supply is connected to the inertia switch. At an aircraft deceleration of 1.5 ± 0.15G, the inertia switch operates and connects the supply to the emergency lamp(s).

With the switch selected to OVERRIDE, the electrical power supply is connected direct to the emergency lamp(s).

NOTE
WIRING AND COMPONENTS SHOWN IN BROKEN LINES INTRODUCED WITH MODS 252065 OR 252135


No.3 BATTERY
PE BUSBAR SUPPLY
EMERGENCY VESTIBULE ENTRANCE ROOF LAMP
NORMAL VESTIBULE ENTRANCE ROOF LAMP
PE BUSBAR
OVERRIDE
SEE PASSENGER COMPARTMENT LIGHTING
PRE MOD 252065 OR 252135
ARMED
PASSENGER COMPARTMENT OPTIONAL ROOF LAMP
INERTIA SWITCH
8082 X

Emergency lighting
Fig.1

* * *

# EMERGENCY LIGHTING - DESCRIPTION AND OPERATION
## (MOD.256229)

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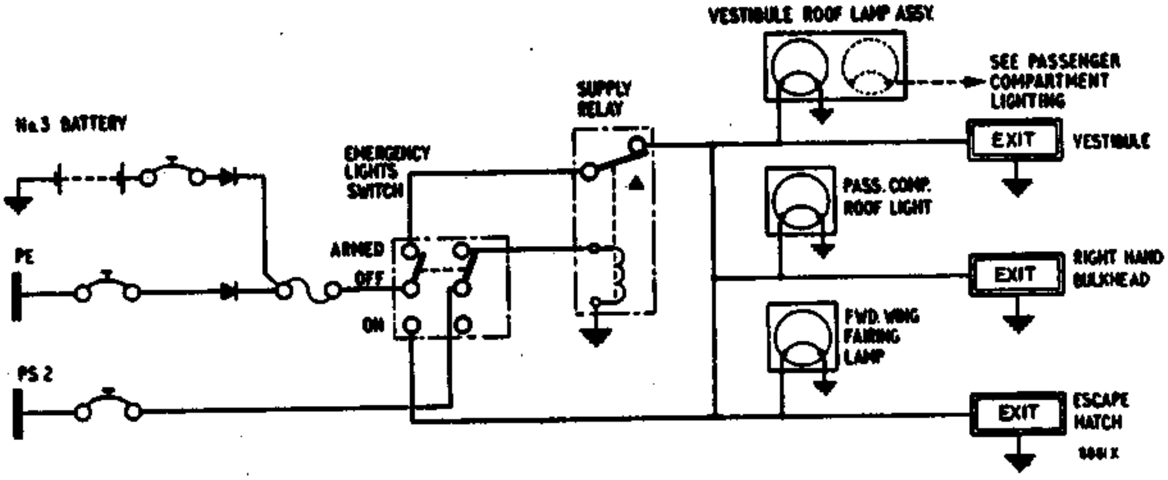
### 1. Description

Electrical power from emergency lighting is supplied from the essential busbar PE or direct from No.3 battery via a relay on panel DA. Control of emergency lighting is effected by a switch labelled EMERGENCY LIGHTS ARMED-OFF-ON, with a red surround, and positioned on the inboard edge of the forward vestibule cabinet. The switch is gated in its three positions; this prevents inadvertent operation, and the switch lever, therefore, requires a definite pull-to-unlock before selection. In the vestibule area, illumination is provided by a single lamp of a twin lamp assembly mounted on the vestibule roof, and above the main entry door an EXIT notice is fitted. In the passenger compartment, EXIT notices are positioned on the forward right-hand bulkhead and also directly above the escape hatch. The escape hatch EMERGENCY EXIT is illuminated by a roof mounted lamp. Installed adjacent to the escape hatch, on the forward wing fairing, is a lamp which illuminates the wing leading edge and an area below.



Emergency lighting - schematic wiring diagram
Fig.1

### 2. Operation

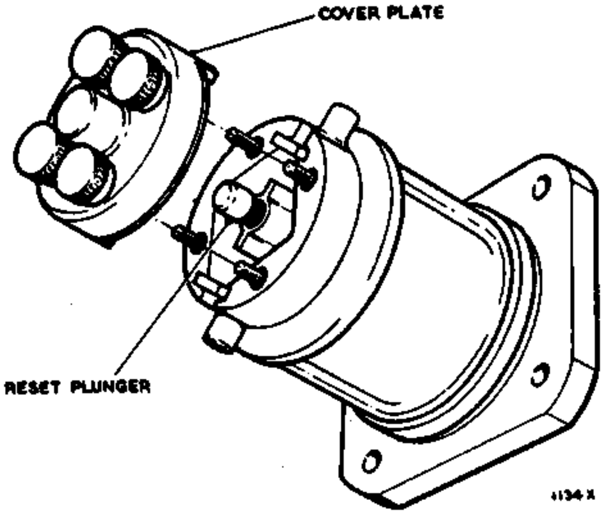
Selecting the EMERGENCY LIGHTS switch to the ARMED position, connects a supply from PS2 to energize the supply relay. The relay contacts changeover to interrupt the emergency lamps and notices supply voltage. Failure of PS2 busbar supply will de-energize the supply relay, and its contacts now revert to the relaxed condition, connecting a supply from PE/No.3 battery to illuminate the lamps and notices. With the EMERGENCY LIGHT switch selected ON, a supply voltage is fed from PE/No.3 battery direct to the lamps and notices.

* * *

## INERTIA SWITCH - DESCRIPTION AND OPERATION

The Graviner inertia switch Type 18C is a single-pole unidirectional switch, mounted terminal end foremost and operated by decelerations of 1.5g ± 0.15g.

The switch comprises an inertia element consisting of a cylinder containing an externally fluted trip piston, which is fitted internally with a damping slug.



Inertia switch
Fig.1

A bowed spring located over the open end of the cylinder bears on the piston crown so that piston movement can only occur when the resistance of the spring is overcome. When this occurs the bow snaps into a reverse bend and bridges a pair of leaf contacts.

The contact terminals, accessible after removal of a cover and gasket, are moulded into a terminal block which also carries a reset plunger.

*        *        *

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## INERTIA SWITCH - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove inertia switch

(1) Isolate the relevant electrical circuit (see Chapter 24, GENERAL).

(2) Release fasteners and open nose cone.

(3) Remove terminal cover and washer, disconnect electrical connections and remove cable entry sleeves. Refit terminal cover, washer and sleeves.

(4) Remove securing bolts and washers and withdraw switch.

#### B. Checks/Tests before installation

(1) For an in-service switch, check for cleanliness, freedom from damage and corrosion. If serviceability is suspect return switch for overhaul.

(2) Examine terminal cover, washer and cable entry sleeves for damage or deterioration and renew as required.

#### C. Install inertia switch

(1) Locate switch on structure and secure with bolts and washers.

NOTE : Ensure that the switch is in the 'set' condition, that is with the piston held in its bore by the pressure of the bow spring on its crown. Reset as necessary by operating the reset plunger.

(2) Remove terminal cover, washer and cable entry sleeves. With cable entry sleeves fitted to cables, secure electrical connections.

(3) Fit terminal cover, washer and with cable sleeves positioned, secure terminal cover.

(4) Close nose cone and secure fasteners.

(5) Restore electrical circuit.

(6) Functionally test relevant circuit.

### 2. Adjustment/Test

#### A. Test inertia switch trip circuit

(1) Ensure No.3 battery is fitted and connected.

(2) Remove switch from structure and support switch so that no strain is exerted on cables.

CAUTION : DO NOT CAUSE THE SWITCH TO RECEIVE ANY BLOW THAT WOULD RESULT IN SWITCH DAMAGE..

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...Inertia switch - Maintenance practices continued

(3) Trip inertia switch and check circuit lamps light.

(4) Remove switch terminal cover and washer, operate reset plunger and check that lamps are extinguished.

(5) Refit switch terminal cover and washer, and secure switch to structure.

B. Insulation test

Equipment required : 250 volt insulation tester.

(1) Isolate electrical supply circuit and disconnect switch external electrical connections.

(2) With switch in the 'set' condition and using the insulation resistance tester, measure the insulation resistance between each terminal and switch body. This must be infinity in both tests.

(3) Restore electrical circuit and secure electrical connections.

* * *

# CHAPTER

# 34

# NAVIGATION

## Chapter 34

## NAVIGATION

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* No separate description
+ No separate maintenance practices

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| * | 34-32-672 | VOR/LOC Suppressed aerials and balance unit | 25FN4939/40A<br>STC 434 LRU 29A |
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## STANDBY COMPASS - MAINTENANCE PRACTICES

### 1. Unit servicing

#### A. Filament renewal

(1) Ensure that new filament is the non-magnetic type, stamped X959121 on the cap.

NOTE : The use of any other filament will cause inconsistent errors in compass indications.

(2) Unscrew filament retaining cap, located adjacent to the cable connector, and withdraw filament from coiled spring.

(3) Insert the new filament in the spring coil. Position and secure the filament retaining cap.

(4) Functionally test the circuit.

### 2. Removal/Installation

#### A. Remove compass

(1) Isolate the compass lamp electrical circuit (see Chapter 24, GENERAL).

(2) Withdraw electrical cable from pins on lamp housing.

(3) Support each retaining bolt in turn and remove securing nut and washers; withdraw bolt. Remove compass from mounting bracket.

NOTE : Bolts are fitted in inverted position, with heads located in compass slots. Do not drop.

#### B. Checks/Tests before installation

Visual check :-

(1) Visually examine the compass. Make certain there is no evidence of leaking and that there is no excessive cloudiness of the liquid.

(2) Using a deflector magnet, rotate the card through 360° and check the graduations, figures and letters for discolouration and flaws.

(3) Check that B and C corrector indicator and index lines (centre of top face of mounting plate) are in alignment.

Friction error check :-

(1) Using the deflector magnet, rotate the card through 10° in one direction and maintain this deflection for about ten seconds to allow the liquid to settle.

(2) Release the card and note its settling position.

(3) Repeat this test, but with the deflection in the opposite direction.

...Standby compass - Maintenance practices continued

(4) The angular difference between the two settling positions must not exceed 2.5°.

NOTE : This figure only applies when the test is conducted in a standard field strength (H) i.e. 0.18 oersted. Where the value of local H differs from this standard, the corresponding permissible error may be calculated as shown in the following example :

Value of standard H = 0.18 oersted
Value of local H = 0.30 oersted

$$\text{Allowable friction error} = 2.5^\circ \text{ (Standard H)} \times \frac{0.18}{0.30} = 1.5^\circ$$

Providing the compass successfully passes these tests it may be installed. Should serviceability be suspect, the compass must be subjected to the procedure in Testing detailed in the Overhaul Manual.

### C. Install standby compass

(1) Align the slots in compass mounting plate with the holes in mounting bracket and insert the retaining bolts.

(2) Position compass so that bolt heads are located centrally in the compass mounting plate. Place light alloy washers over bolt threads extruding through top of mounting bracket. Fit and tighten requisite nuts.

CAUTION : DO NOT OVERTIGHTEN NUTS.

(3) Connect electrical cable to lamp housing and, if new cable being fitted, route through to terminal block and diode. Strap cable to canopy top rail drain pipe.

(4) Restore the compass lamp electrical circuit.

(5) Energize relevant busbar (Refer to relevant NAVIGATIONAL AIDS - DESCRIPTION).

(6) Check that the brilliance of the compass card lighting varies with rotation of the ROOF AND CONTROLLERS dimmer. Return dimmer to OFF.

(7) Effect a full compass swing (para.2A).

## 2. Adjustment/Test

### A. Compass swing

A compass swing must be carried out and compensations (where necessary) effected whenever a new compass is installed; on other occasions a check swing is sufficient. The check swing is normally effected by placing the aircraft on various magnetic headings and comparing the deviations with those on the deviation cards on the pilots' roof panel. If a difference occurs, a complete swing must be carried out. Compasses should be check swung on the following occasions:-

(a) When the accuracy of the compass is suspect.

(b) After a major inspection.

(c) After any modification or major replacement involving ferrous metal.

(d) Whenever compass has been subjected to a shock, for example, after a heavy landing.

(e) After aircraft has passed through an electrical storm.

(f) Whenever a change is made to the electrical system.

(g) Whenever a change of cargo is likely to affect the compass.

(h) Whenever sphere of operations is changed to one of different magnetic latitude.

(j) After aircraft has been standing on one heading for a long period.

NOTE : A check should always be made on each heading to ensure that neither the interference from each individual item of electrical equipment and its associated wiring, nor the interference from the worst combination of possible electrical loads, has been increased. This interference should, normally, not exceed 1° for individual items and 2° for the worst combination.

Prepare for swinging

(1) Check aircraft to ensure that all airborne equipment is properly installed. No items or tools of magnetic material should be introduced into the aircraft other than those normally carried as part of the airborne equipment.

(2) If available connect and switch on ground supply; if ground supply is not available start both engines (see Chapter 71, POWER PLANT - GENERAL).

(3) To provide normal electrical interference conditions during deviation checks, switch on the following equipment :-

(a) Main inverter(s).
(b) Artificial horizon(s).
(c) Turn and slip indicator(s).

....(s) - As applicable on a particular aircraft for normal flight conditions.

(d) Flight compartment panel lights.

...Standby compass - Maintenance practices continued

| | |
|---|---|
| (e) Pitot heaters | Restrict continuous operation. Only to be switched on during each individual heading check. The pitot heaters and masts must not be left on for more than 10 minutes. |
| (f) Pitot masts | |
| (g) Fuel pumps (if engines are not running) | |

(4) It is recommended that readings on all relevant compasses should be taken and all necessary adjustments made as required on each heading at the same time.

Swinging procedure

(1) Position aircraft on the approved swinging base to face N. Check alignment of aircraft with a landing compass located approximately 50 feet ahead of the aircraft nose. Sight with centre of radome and centre line of vertical stabilizer leading edge. Record readings of E2B compass and reciprocals of landing compass readings (Landing compass reading + 180°).

NOTE : Landing compass shows reciprocal heading of E2B compass reading. Therefore, add 180° to landing compass readings to approximate the E2B reading at N.

(2) Head aircraft E and record readings of both compasses.

(3) Head aircraft S and again record readings of both compasses. Calculate coefficient C from equation. $C = \frac{N-S}{2}$ where N and S represent errors on North and South headings respectively. For example, if error at N = -6 and at S = -2 then $C = \frac{(-6) - (-2)}{2} = \frac{-6+2}{2} = \frac{-4}{2} = -2^{\circ}$

(4) Change sign of coefficient C, obtained in para.3 and add algebraically to E2B reading. Fit corrector key over C spindle and adjust E2B to read this figure. In the above example the corrector would be adjusted until 184 deg. aligned with the lubber.

(5) Head aircraft W and note reading of both compasses. Calculate coefficient B from equation : $B = \frac{E-W}{2}$ where E and W represent errors on East and West headings respectively.

For example, if error at E = +2 and at W = -0 ; then $B = \frac{+2-0}{2} = \frac{+2}{2} = +1$

(6) Change sign of coefficient B obtained in para.5 and add algebraically to E2B reading. Fit corrector key over B spindle and adjust E2B to read this figure. In the example of (5) align reading 269° against lubber.

...Standby compass - Maintenance practices continued

(7) On the fourth cardinal point west, calculate the amount of coefficient A. This is derived from the sum of the deviations on : $\frac{N + E + S + W}{4}$

For example $\frac{-4 + 1 - 4 + 1}{4} = \frac{-6}{4} = -1\frac{1}{2}^{\circ}$

NOTE : If coefficient A exceeds 2° recheck coefficient B and C.

(8) First note E2B reading and then slacken compass retaining bolts. Rotate compass by the amount of coefficient A obtained in (7), turning clockwise for 'plus' errors and anti-clockwise for 'minus' errors. Tighten retaining bolts and recheck E2B reading, which should now be altered by the amount of A coefficient correction applied.

(9) Head aircraft in succession on quadrantal and cardinal points from W to W, starting at NW. Record readings of both compasses at each heading, then calculate final coefficient A. This is derived from the sum of the deviations on; $\frac{N,\ E,\ S,\ W,\ NW,\ NE,\ SE,\ SW}{8}$.

For example A; $= \frac{-4 + 1 - 4 + 1 + 0 - 1 - 1 - 2}{8} = \frac{-10}{8} = -1\frac{1}{4}^{\circ}$

Apply -1° correction as in para. 8.

(10) Record all E2B compass readings obtained after application of coefficient A corrections. (If applicable) Compile log book entries and deviation cards from the corrected readings.

* * *

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## PITOT/STATIC SYSTEM - DESCRIPTION

### 1. General

The system serves the pressure operated flight instruments, the mach/airspeed warning system (Chapter 34 - MACH/AIRSPEED AUDIBLE WARNING SYSTEM - DESCRIPTION AND OPERATION), the cabin pressurization system (Chapter 21 - PRESSURIZATION CONTROL - DESCRIPTION AND OPERATION), and stall warning equipment. Provision is made for the connection of various additional equipment.

Pitot and static pressure is provided by two pitot heads and four static vent plates respectively. Two wing vents provide stall vent pressure.

The pitot/static system is shown diagrammatically on Fig.1.

### 2. Pitot heads

The pitot heads, mounted one on each side of the fuselage nose, provide independent pressure supplies as follows :-

| | |
|---|---|
| LH pitot head .. | LH airspeed indicator and machmeter or combined mach/airspeed indicator. |
| RH pitot head .. | RH airspeed indicator, stall detectors, mach and airspeed pressure switches (2) warning horn speed switch (Mod.252175), and additional equipment connections. |

Both pitot heads, and the masts by which they are attached to the fuselage, are electrically heated.

Water traps and drains are provided in the pipelines, a water drain screw is provided at the rear of each pitot head.

### 3. Static vent plates

These are mounted two each side of the fuselage nose. Four static vents are provided in each rear plate and two in each front plate. The vents, numbered for reference are interconnected as shown on Fig.1. Six static sources are thus provided to supply the following :-

| | |
|---|---|
| Static 1 .. | LH altimeter, machmeter. |
| Static 2 .. | RH altimeter, stall detectors (Pre Mod.251948), mach pressure switch, FL100 pressure switch (Pre Mod.252151), and additional equipment connections. |
| Static 3 .. | LH vertical speed indicator. |
| Static 4 .. | RH vertical speed indicator (when fitted), cabin differential pressure indicator. |
| Static 5 .. | LH airspeed indicator or combined mach/airspeed indicator. |
| Static 6 .. | RH airspeed indicator or combined mach/airspeed indicator, airspeed pressure switches (2), Stall detectors (Mod.251948), and warning horn speed switch (Mod.252175). |

Drains are provided in static 2, 4 and 6 lines.

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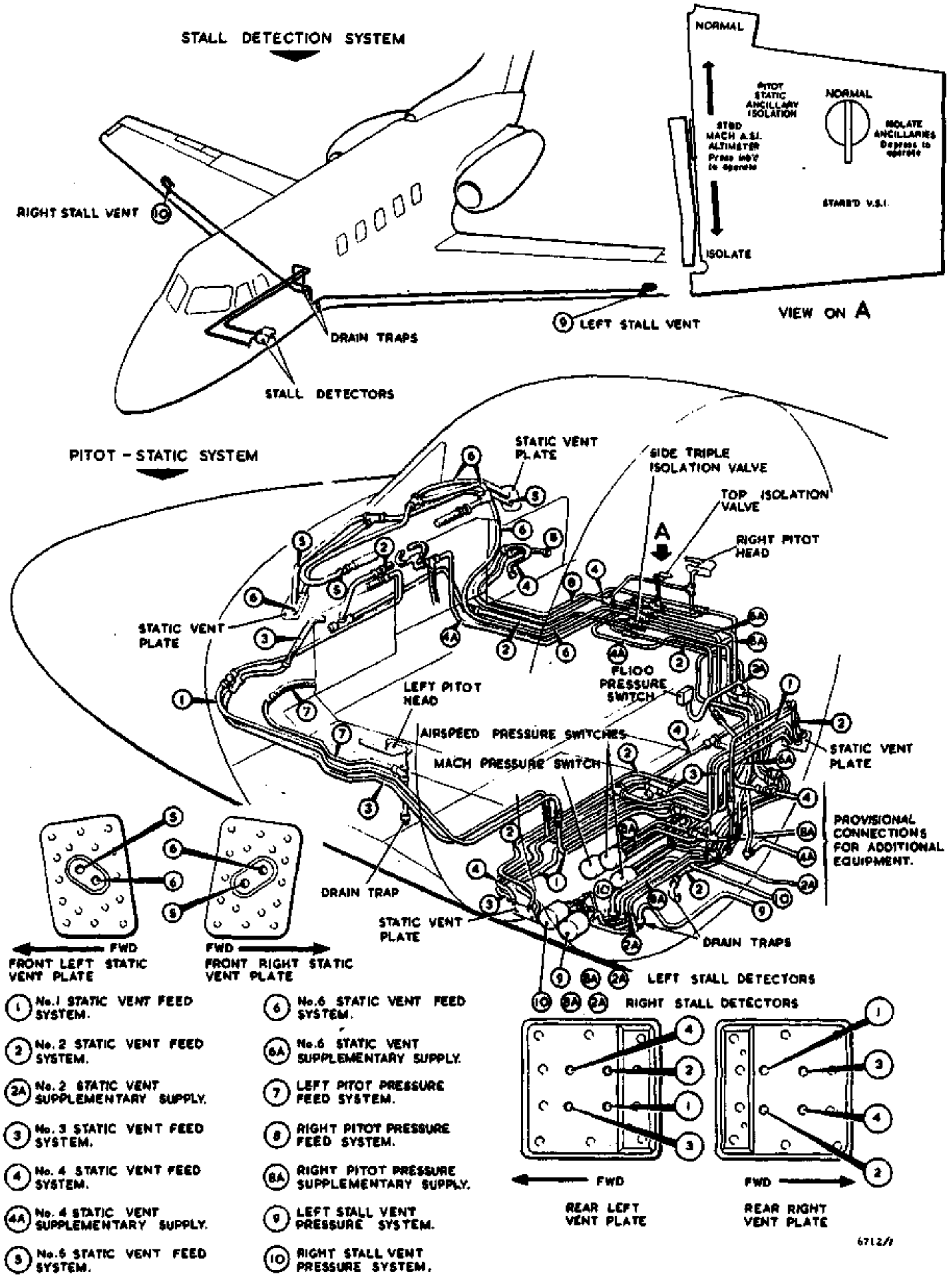
STALL DETECTION SYSTEM
RIGHT STALL VENT ⑩
DRAIN TRAPS
STALL DETECTORS
⑨ LEFT STALL VENT
NORMAL
PITOT STATIC ANCILLARY ISOLATION
NORMAL
STBD MACH A.S.I. ALTIMETER
ISOLATE ANCILLARIES Depress to operate
STARB'D V.S.I.
ISOLATE
VIEW ON A
PITOT - STATIC SYSTEM
STATIC VENT PLATE
SIDE TRIPLE ISOLATION VALVE
TOP ISOLATION VALVE
A
RIGHT PITOT HEAD
STATIC VENT PLATE
F100 PRESSURE SWITCH
LEFT PITOT HEAD
AIRSPEED PRESSURE SWITCHES
MACH PRESSURE SWITCH
STATIC VENT PLATE
PROVISIONAL CONNECTIONS FOR ADDITIONAL EQUIPMENT.
DRAIN TRAP
STATIC VENT PLATE
DRAIN TRAPS
⑨ 8A 2A LEFT STALL DETECTORS
⑩ 8A 2A RIGHT STALL DETECTORS
FWD
FRONT LEFT STATIC VENT PLATE
FWD
FRONT RIGHT STATIC VENT PLATE
FWD
REAR LEFT VENT PLATE
FWD
REAR RIGHT VENT PLATE
① No.1 STATIC VENT FEED SYSTEM.
② No.2 STATIC VENT FEED SYSTEM.
2A No.2 STATIC VENT SUPPLEMENTARY SUPPLY.
③ No.3 STATIC VENT FEED SYSTEM.
④ No.4 STATIC VENT FEED SYSTEM.
4A No.4 STATIC VENT SUPPLEMENTARY SUPPLY.
⑤ No.5 STATIC VENT FEED SYSTEM.
⑥ No.6 STATIC VENT FEED SYSTEM.
6A No.6 STATIC VENT SUPPLEMENTARY SUPPLY.
⑦ LEFT PITOT PRESSURE FEED SYSTEM.
⑧ RIGHT PITOT PRESSURE FEED SYSTEM.
8A RIGHT PITOT PRESSURE SUPPLEMENTARY SUPPLY.
⑨ LEFT STALL VENT PRESSURE SYSTEM.
⑩ RIGHT STALL VENT PRESSURE SYSTEM.
6712/1

Location of pitot-static and
stall detection units
(Pre Mod.251948)
Fig.1

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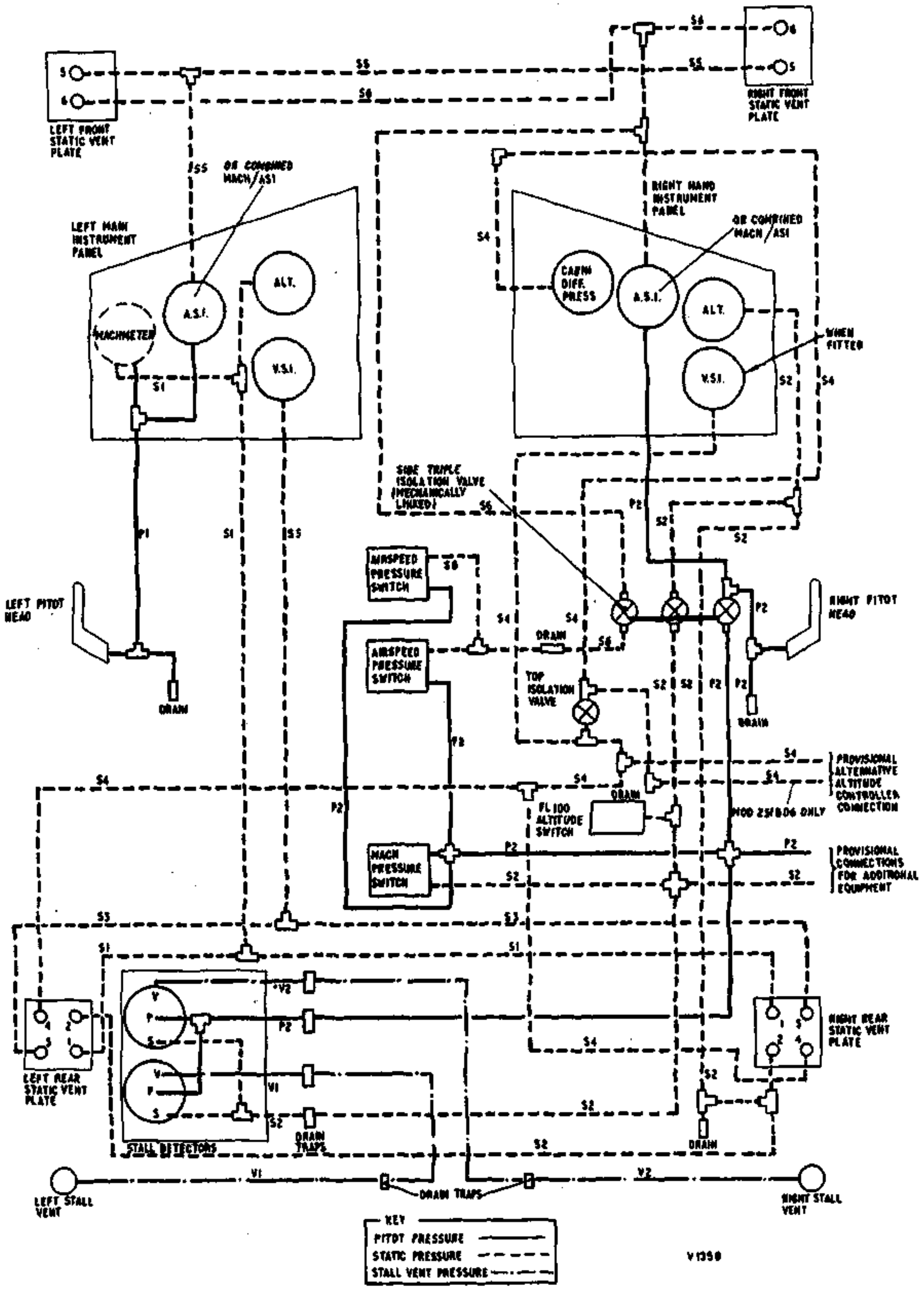
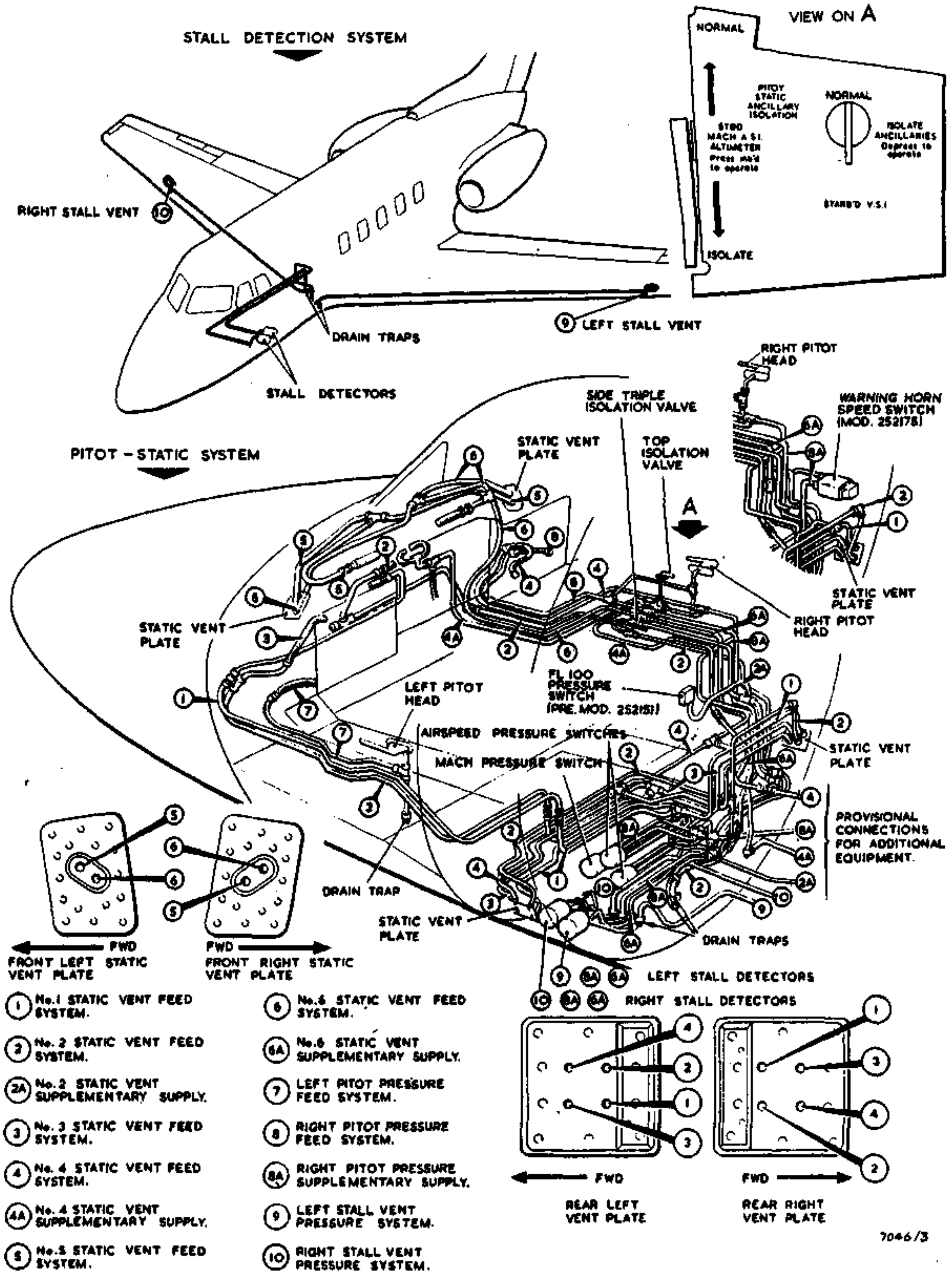


Pitot/static and stall vent systems - schematic diagram (Pre Mod.251948)
Fig.2



| | |
|---|---|
| ① | No.1 STATIC VENT FEED SYSTEM. |
| ② | No.2 STATIC VENT FEED SYSTEM. |
| (2A) | No.2 STATIC VENT SUPPLEMENTARY SUPPLY. |
| ③ | No.3 STATIC VENT FEED SYSTEM. |
| ④ | No.4 STATIC VENT FEED SYSTEM. |
| (4A) | No.4 STATIC VENT SUPPLEMENTARY SUPPLY. |
| ⑤ | No.5 STATIC VENT FEED SYSTEM. |
| ⑥ | No.6 STATIC VENT FEED SYSTEM. |
| (6A) | No.6 STATIC VENT SUPPLEMENTARY SUPPLY. |
| ⑦ | LEFT PITOT PRESSURE FEED SYSTEM. |
| ⑧ | RIGHT PITOT PRESSURE FEED SYSTEM. |
| (8A) | RIGHT PITOT PRESSURE SUPPLEMENTARY SUPPLY. |
| ⑨ | LEFT STALL VENT PRESSURE SYSTEM. |
| ⑩ | RIGHT STALL VENT PRESSURE SYSTEM. |

Location of pitot-static and
stall detection units
(Mod.251948)
Fig.3

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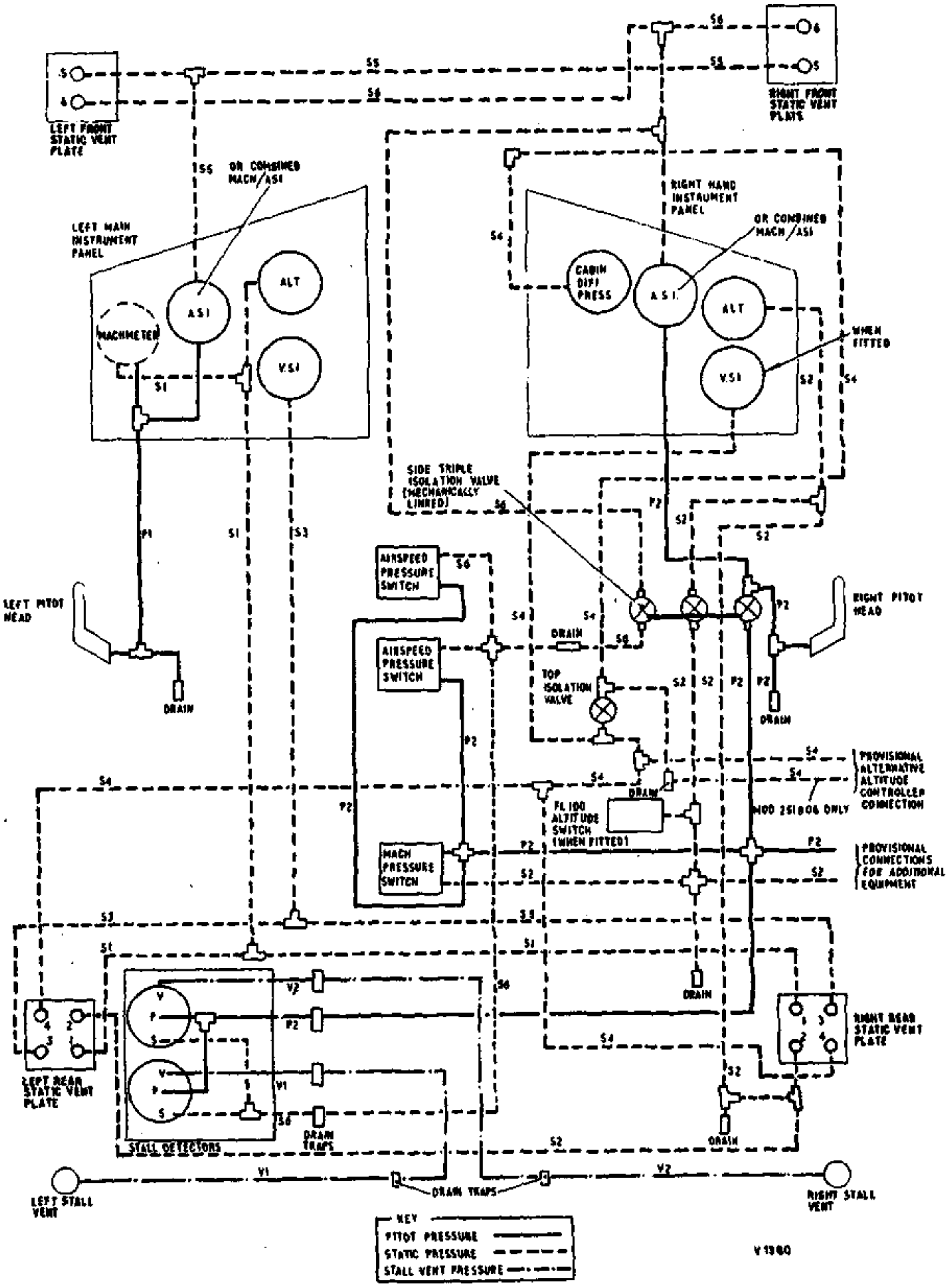
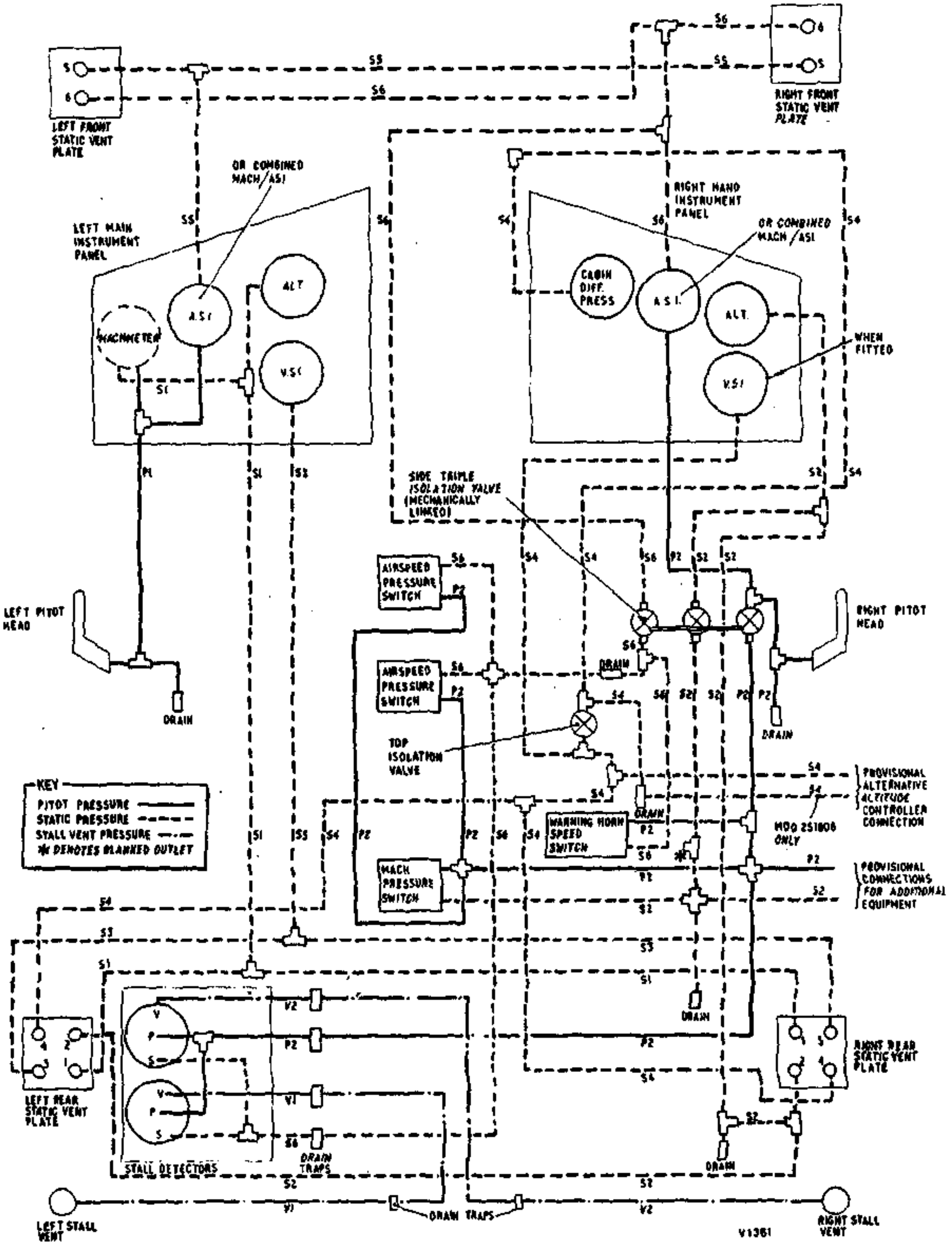

LEFT FRONT STATIC VENT PLATE
RIGHT FRONT STATIC VENT PLATE
LEFT MAIN INSTRUMENT PANEL
OR COMBINED MACH/ASI
MACHMETER
A.S.I
ALT
V.S.I
RIGHT HAND INSTRUMENT PANEL
CABIN DIFF PRESS
WHEN FITTED
LEFT PITOT HEAD
RIGHT PITOT HEAD
DRAIN
SIDE TRIPLE ISOLATION VALVE (MECHANICALLY LINKED)
TOP ISOLATION VALVE
AIRSPEED PRESSURE SWITCH
MACH PRESSURE SWITCH
FL 100 ALTITUDE SWITCH (WHEN FITTED)
MOD 251806 ONLY
PROVISIONAL ALTERNATIVE ALTITUDE CONTROLLER CONNECTION
PROVISIONAL CONNECTIONS FOR ADDITIONAL EQUIPMENT
LEFT REAR STATIC VENT PLATE
RIGHT REAR STATIC VENT PLATE
STALL DETECTORS
DRAIN TRAPS
LEFT STALL VENT
RIGHT STALL VENT
P1
P2
S1
S2
S3
S4
S5
S6
V1
V2
KEY
PITOT PRESSURE
STATIC PRESSURE
STALL VENT PRESSURE
V1380

Pitot/static and stall vent systems - schematic diagram (Mod.251948, Pre Mod.252151 and 252175)
Fig.4



Pitot/static and stall vent systems - schematic diagram (Mod.251948, 252151 and 252175)
Fig.5

## 4. Ancillary equipment isolation

Two PITOT-STATIC isolation controls, located on the right side console, provide a means of isolating the ancillary pitot-static operated equipment from the inter-connected flight instruments. The side control is connected into static 2 and 6 lines and into the right-hand pitot head pressure line. The top control is connected into static 4 line.

With both controls in the NORMAL position, pitot and static pressure is supplied to all applicable instruments and equipment. The top control is DEPRESSed to OPERATE, and the side control PRESSed INBoarD TO OPERATE. Selecting the side control to ISOLATE maintains the supplies to the RH airspeed indicator or combined Mach/airspeed indicator and to the RH altimeter but isolates the following :-

Stall detectors, FL100 pressure switch (Pre.Mod.252151)
Mach and airspeed pressure switches (2).
Warning horn speed switch (Mod.252175)
Additional equipment connections.

Selection of the top control to ISOLATE maintains the static supply to the RH vertical speed indicator (when fitted) but isolates the supply to the following :-

Cabin differential pressure indicator.
Additional equipment connections.

## 5. Stall vents

A stall vent is mounted on the underside of each wing. Each vent is connected by a pipeline which incorporates a water trap and drain, to an associated stall detector.

## 6. Stall warning

Pitot and static pressure is supplied from the RH pitot head and static 2 system (pre Mod.251948) or static 6 system (Mod.251948) respectively, to two capsule-operated stall detectors. Stall vent pressure is supplied to the left stall detector from the left stall vent and to the right stall detector from the right stall vent. When the aircraft approaches the stall, these pressures operate the stall detectors to route electrical supplies to a stick shaker motor on the left-hand control column. Operation of either stall detector will cause the stick shaker to operate.

Two STALL warning TEST switches are provided on the roof panel. Operation of either switch to TEST will cause the stick shaker to operate.

Electrical power supplies to the stall detectors and the stick shaker motor are fed from busbar PE.

* * *

# PITOT/STATIC SYSTEM - MAINTENANCE PRACTICES

## 1. General

When instruments or components in the pitot system are disconnected, or when no more than a single disconnection is made between two pipes, or when the system is in any way suspect, that system must be tested as laid down in para.3A. Similarly, a static system so disturbed or suspect, must be tested in accordance with para.3B. Para.3C details the test required under similar circumstances, for the stall vent pressure system.

Reference to the PITOT/STATIC SYSTEM - DESCRIPTION and the relevant NAVIGATIONAL AIDS - DESCRIPTION will indicate the system or systems to be tested due to instrument or component removal. Where more than a single disconnection is made, other than disconnection at instruments or components, that system must be tested as detailed in para.3D.

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## 2. System servicing (Fig.201 and 202)

(1) Using a suitable receptacle, drain water from each drain valve in turn by depressing and holding the spring loaded valve open and apply a low pressure air supply to the relevant pitot or static vent. Sharply release pressure on the valve to ensure that the drain valve reseats correctly.

NOTE : Maximum permissible pressure on static system is 0.5 lb/sq.in.

## 3. Adjustment/Test

### A. Pressure test complete pitot system

CAUTION : DO NOT SUBJECT PRESSURE HEADS TO SIDELOADS.

Equipment required :-

Pressure test rig capable of delivering up to 5.0 lb/sq.in. pressure.
Pressure head adapter WIDS 308C.
Leak testing solution - 5% Nonidet LE with 95% distilled water.

Conversion readings :-
350 knots, 2168.2 mm WG, 212.87 m.b., 3.088 lb/sq.in. or 6.286 in.Hg.

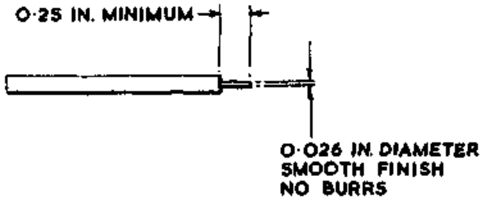
Right-hand pitot system

(1) Isolate pressure head and stall detector electrical circuits (see Chapter 24, GENERAL).

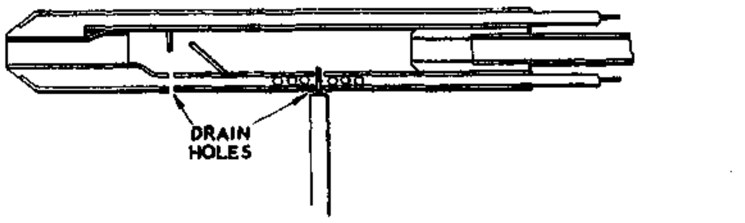
NOTE : If fitted, ensure that isolation valve(s), on the right-hand console, is in the normal (open) position.

(2) Ensure that pipeline water trap(s) is free from water and that drain valve(s) is closed.

(3) Using tool depicted on Fig.201, ensure that both drain holes in pressure head are clear (see Fig.201). Ensure that the drain trap is free from water, by releasing drain screw and allowing water to escape. When water flow ceases, tighten drain screw and wire-lock.



DRAIN HOLE CLEARING TOOL



TOOL IN OPERATION

Drain hole clearing tool and method of use
Fig.201

(4) Fit test adapter WIDS 308C to right-hand pressure head, ensuring that drain holes are completely covered.

(5) Connect inflator hose of pressure test rig to adapter.

(6) Slowly operate test rig pump. When a pressure equivalent to an airspeed of 350 knots is registered on the rig indicator, turn off the test rig isolation valve and cease pumping.

(7) Check that test pressure is maintained for 2 minutes.

(8) Should pressure fall within the specified time, test joints and drain valves using leak testing solution.

(9) Rework all faulty connections until satisfactory, then wire-lock.

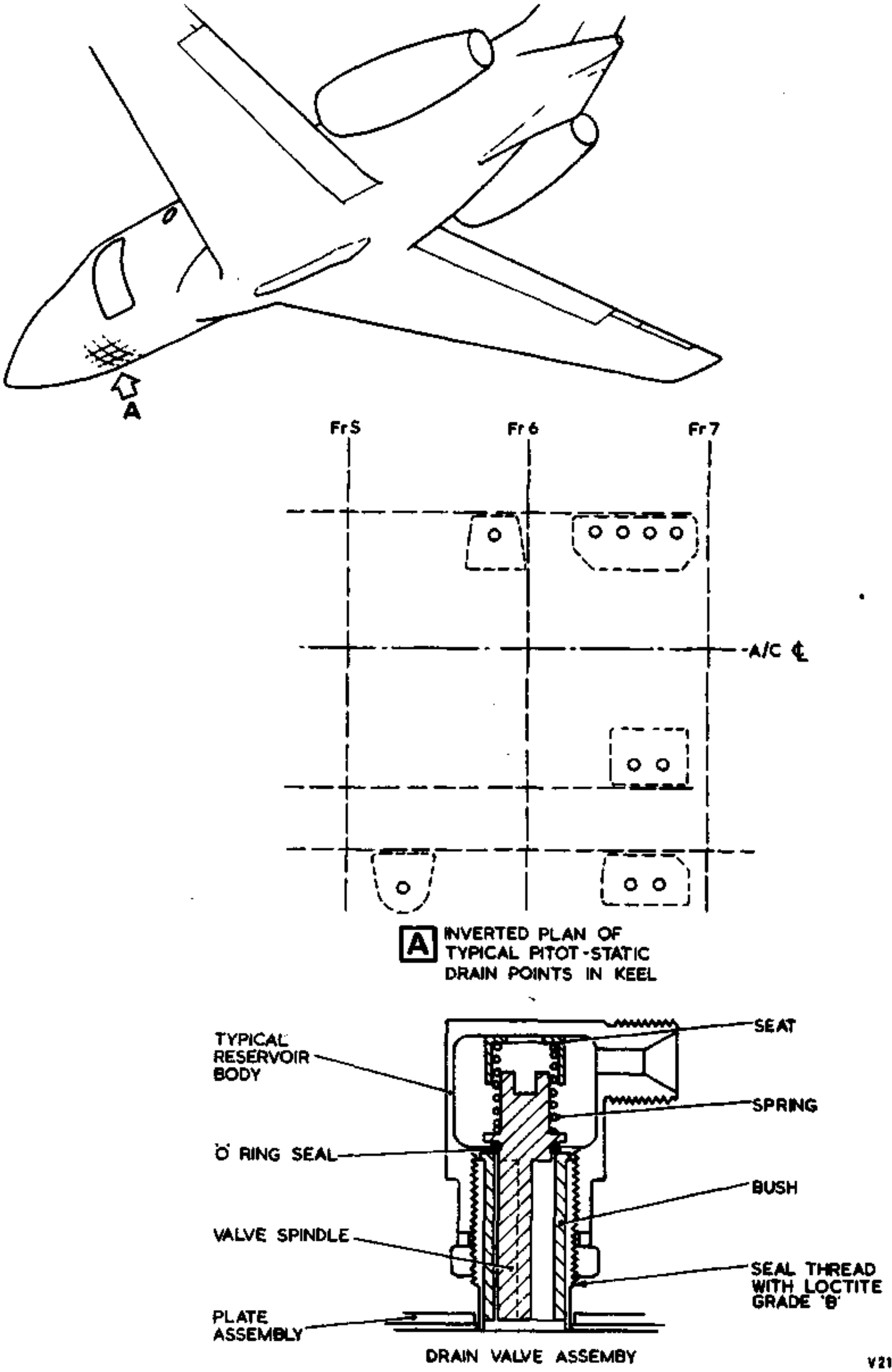
(10) Remove all traces of solution with distilled water, and thoroughly dry.

(11) Slowly release air pressure from the system.

(12) If fitted, test serviceability of isolation valve as follows :-

   (a) Turn isolation valve, situated on the right-hand console, to its isolate (closed) position.

   (b) Repeat operations (5),(6) and (7).



Typical pitot/static drains in keel
Fig.202

(c) No drop in pressure, over the stipulated period, will indicate that the isolation valve is serviceable. However, this will not prove to be a true test if a large leak in the isolation valve has allowed the isolated part of the system to be pressurized during operation (6). To establish that this is not so, move the isolation valve as slowly as possible to its normal (open) position, ensuring that there is an associated drop in indicated air pressure on the test rig indicator as air pressure escapes into the unpressurized (isolated) part of the system.

(13) Disconnect test rig from adapter, and remove adapter from pressure head.

(14) Restore pressure head and stall detector electrical supplies.

Left-hand pitot system

(15) Isolate pressure head electrical circuit.

(16) Repeat operations (2) to (11) inclusive and (13) and (14) for the left-hand system.

B. Suction test complete static system

Equipment required :-

Pressure test rig capable of delivering pressure up to 5 lb/sq.in.
Suction test rig capable of producing suction up to 10 lb/sq.in.
Expanding plug adapter 25Y TS 129R/21A.
Expanding plug blank 25Y TS 129R/23A.
Pressure head adapter WIDS 308C.
Leak testing solution - 5% Nonidet LE with 95% distilled water.

Conversion readings :-

130 knots, 281.8 mm WG, 27.66 m.b., 0.401 lb/sq.in. or 0.817 in.Hg.
200 knots, 678.3 mm WG, 66.6 m.b., 0.97 lb/sq.in. or 1.98 in.Hg.
350 knots, 2168.2 mm WG, 212.87 m.b., 3.088 lb/sq.in. or 6.286 in.Hg.
558 knots, 6110 mm WG, 599 m.b., 8.7 lb/sq.in. or 17.71 in.Hg.

CAUTION : WHEN THE SYSTEM CONTAINING AN AUTOPILOT ALTITUDE CONTROLLER IS TO BE TESTED, THE A.C. BUSBARS MUST BE ENERGIZED (SEE CHAPTER 24, GENERAL) AND ENSURE THAT THE ALTITUDE HOLD SWITCH IS OFF.

(1) Ensure that pipeline water trap is drained of water and that drain valve is reseated correctly.

(2) Fit expanding plug blank in static vent of system under test on left static vent plate.

(3) Fit expanding plug adapter in static vent of system under test on right static vent plate.

(4) Connect hose from suction test rig to expanding plug adapter.

(5) Gradually apply suction to the system, and when a suction equivalent to a reading of 558 knots for No.1 and 2 systems only or 350 knots is registered on the rig indicator, lock the suction system and cease pumping.

NOTE : Before commencing test on No.1 and 2 system, only, apply a pressure of 200 knots to respective pitot system and ensure it is maintained throughout the static test.

(6) Check that suction is maintained for 5 minutes.

(7) Should leakage be present, check joints to instruments, components and adapters. Rectify faulty joints and wire-lock.

(8) Should leakage persist, release suction and disconnect test rig suction hose from expanding plug adapter and proceed as follows :-

CAUTION : WHEN FAULT FINDING STATIC SYSTEMS No.1 AND No.2, RELEASE STATIC PRESSURE BEFORE RELEASING PITOT PRESSURE, OTHERWISE SEVERE DAMAGE TO MACHMETER, MACH PRESSURE SWITCH AND AIRSPEED PRESSURE SWITCH MAY ENSUE.

(a) Connect pressure line of test rig to expanding plug adapter, and pressurize system to a pressure not exceeding that required to register 130 knots on the test rig indicator.

(b) Using leak testing solution test suspect connections and drain valves.

(c) Rectify faulty joints as necessary and wire-lock.

(d) Release air pressure from the system and disconnect test rig.

(e) Remove all traces of test solution with distilled water, and thoroughly dry.

(f) Reconnect suction test rig to system and retest system.

(g) When test requirements are satisfied, release suction slowly.

CAUTION : AFTER COMPLETION OF TEST ON STATIC SYSTEMS No.1 AND No.2, RELEASE STATIC PRESSURE BEFORE RELEASING PITOT PRESSURE, OTHERWISE SEVERE DAMAGE TO MACHMETER, MACH PRESSURE SWITCH AND AIRSPEED PRESSURE SWITCH MAY ENSUE.

(h) Disconnect and remove test rig.

(9) If fitted, test serviceability of isolation valve as follows :-

(a) Turn isolation valve, situated on the right-hand console, to its isolate (closed) position.

(b) Repeat suction test operations (2) to (6) inclusive.

(c) No change in indicated pressure, over the stipulated period, will indicate that the isolation valve is serviceable. However this will not prove to be a true test if a large leak in the isolation valve has allowed the isolated part of the system to be equally vacated during operation (5). To establish that this is not so, move the isolation valve as slowly as possible to its normal (open) position, ensuring that there is an associated drop in indicated air pressure on the test rig indicator as air pressure escapes into the vacated part of the system.

(d) When test requirements are satisfied, release suction and disconnect test rig.

(10) Disconnect and remove expanding plug blank and adapter from static vents.

C. Pressure test stall warning system

Equipment required :-

Pressure test rig capable of delivering up to 5.0 lb/sq.in. pressure.
Expanding plug adapter WIDS 107G.
Leak testing solution - 5% Nonidet LE with 95% distilled water.

Conversion readings :-

350 knots, 2168.2 mm WG, 212.87 m.b., 3.088 lb/sq.in. or 6.286 in.Hg.

(1) Pressurise right-hand pitot system as detailed in para.3A.

(2) Ensure that pipeline water traps are free from water, and that drain valves are closed.

(3) Fit expanding plug adapter to relevant stall vent.

(4) Connect test rig pressure hose to plug adapter.

(5) Slowly operate test rig pump. When a pressure equivalent to an air speed of 350 knots is registered on rig indicator, turn isolating valve 'off' and cease pumping.

(6) Check that test pressure is maintained for 2 minutes.

(7) Should pressure fall before 2 minutes has elapsed, test joints and drain valves using leak testing solution.

(8) Rework all faulty connections until satisfactory, then wire-lock. Slowly release test pressure.

(9) Remove all traces of test solution with distilled water, and thoroughly dry.

(10) Disconnect test equipment and remove adapters. Remove test rig.

(11) Restore stall detector(s) and pitot head electrical supply.

D. Pitot/Static pipelines pressure test

Equipment required :-

Pressure test rig capable of delivering up to 10 lb/sq.in. pressure.

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Adapter for pressure head WIDS 308C
U - connections TS 116R-5
U - connections TS 116R-3
Expanding plug adapter 25Y TS 129R 21A
Expanding plug blanks 25Y TS 129R 23A
Blanks suitable for instrument adapters.

NOTE : (a) To ensure that the correct disconnections are made in operation (1) of the following test procedure, refer to PITOT/STATIC - DESCRIPTION and the relevant aircraft's NAVIGATIONAL AIDS - DESCRIPTION and note the particular instruments and components coupled to the system(s) under test.

(b) If applicable, ensure that the isolation valve(s) is in the normal (open) position.

(c) Slowly release test pressure before reworking any leaking joints and repeat test as necessary to prove rectification.

(1) Ensure that all instruments and components coupled to the relevant systems being tested are disconnected and suitable blanks fitted. Where necessary, fit U-connections to interconnect pitot and static pipes to facilitate simultaneous testing of related pipelines. Fit blanks where pipe connections are exposed to atmosphere and blank static vents where necessary.

(2) Connect a clean, dry air supply to orifice through which test pressure connection will be made, and, removing and replacing each blank in turn, blow system through, ensuring that full airflow emerges through open orifice. Fit final blank, and remove air supply.

(3) Fit test adapter WIDS 308C (to pitot head), or expanding plug adapter WIDS 107B (to static or stall vent), as required. Where pressure test rig is connected to pitot head, ensure that pitot head drain holes are completely and effectively covered.

(4) Ensure that system(s) drain traps are drained free of water and are reseated correctly.

(5) Connect test unit pressure line to relevant adapter, and close a.s.i. isolating valve on rig. Raise rig pressure slowly to 10 lb/sq.in., and shut reservoir isolating valve. Check that system pressure is maintained for 10 minutes.

(6) Whilst the test is in progress, put a film of leak testing solution over the drain valve outlets. Check that film does not break throughout test.

(7) Should test pressure drop, check pipeline and hose joints, drain screw on pitot head, and all blanked orifices, with leak testing solution.

(8) Rectify any leaks and retest system until test requirements are satisfied.

(9) Release test pressure slowly, disconnect and remove test unit.

(10) Remake all broken joints, remove U-connections and remake instrument connections

(11) Ensure that pipelines are correctly assembled and locked.

(12) Remove test adapter or expanding plug adapter.

(13) Remove blanking plugs from static vents.

(14) When all instruments and components are reconnected :-

Pressure test complete relevant pitot system.
Suction test complete relevant static system.

## 4. Removal/Installation

### A. Remove pipe

CAUTION : MAINTAIN NATURAL FALL OF PIPELINES, SAGGING BETWEEN CLAMPS WILL PREVENT SYSTEM DRAINING.

(1) Disconnect joints at each end of pipe.

(2) Remove P-clips securing pipe to airframe. Retain P-clips and remove pipe.

(3) Fit blanks to exposed ends to prevent ingress of dirt or moisture.

### B. Install pipe

(1) Obtain new pipe, and blow it through with clean dry air, so ensuring cleanliness and freedom from obstruction. Ensure that belled ends and their mating adapters are clean and undamaged.

(2) Position pipe, and connect joints at each end.

NOTE : Where a pipe is being connected to a hose, ensure that hose is not twisted during tightening of nut.

(3) Carefully locate P-clips in their original positions, and fasten P-clips to secure pipe to airframe.

NOTE : Ensure that the pipe cannot chafe against other pipelines, airframe structure or any installed equipment.

(4) After installation, pressure test the pipeline system (Para.3D).

(5) Wire-lock newly made joints.

* * *

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## PRESSURE HEAD - MAINTENANCE PRACTICES

### 1. Removal/Installation

CAUTION : DO NOT USE THE PRESSURE HEAD AS A 'HANDHOLD' AS DAMAGE AND MISALIGNMENT WILL RESULT.

### A. Remove pressure head

(1) Isolate relevant pressure head electrical circuit (see Chapter 24, GENERAL).

(2) Gain access to terminal block and remove cover, disconnect and remove electrical cables. Refit cover.

(3) Disconnect pressure pipe at adapter, and blank off exposed connections.

(4) Remove pressure head securing bolts, support pressure head, and apply pressure to unit from inside fuselage, thus breaking Thiokol seal. Remove pressure head.

### B. Install pressure head

Materials required :

| | |
|---|---|
| Thiokol .. .. .. | PR.1431T |
| Release agent .. .. | Manucol SS/LH - sodium alginate |

NOTE : Ensure that pressure head is correct type - that is, the water drain hole is at the bottom.

(1) Remove all traces of aged Thiokol from fuselage landing face.

(2) Apply Thiokol to fuselage landing face in accordance with DHA447 (see Chapter 20).

(3) Examine pressure head and check that it is free from cracks, distortion, corrosion or signs of any other deterioration.

(4) Apply release agent to pressure head landing face.

(5) Remove terminal block cover.

(6) Position pressure head and secure with bolts, washers and stiffnuts.

(7) Remove excess Thiokol.

(8) Connect electrical cables to appropriate terminals, refit and secure terminal block cover. Insert and tighten securing screws and wire-lock.

(9) Remove blanking caps from pressure head adapter and pressure pipe connector. Connect pressure pipe to adapter.

(10) Pressure test relevant pitot system (see Chapter 34, PITOT/STATIC SYSTEM) and wire-lock connection.

(11) Restore relevant pressure head electrical supply.

(12) Functionally test relevant pitot and mast heaters (see Chapter 30, PITOT HEADS).

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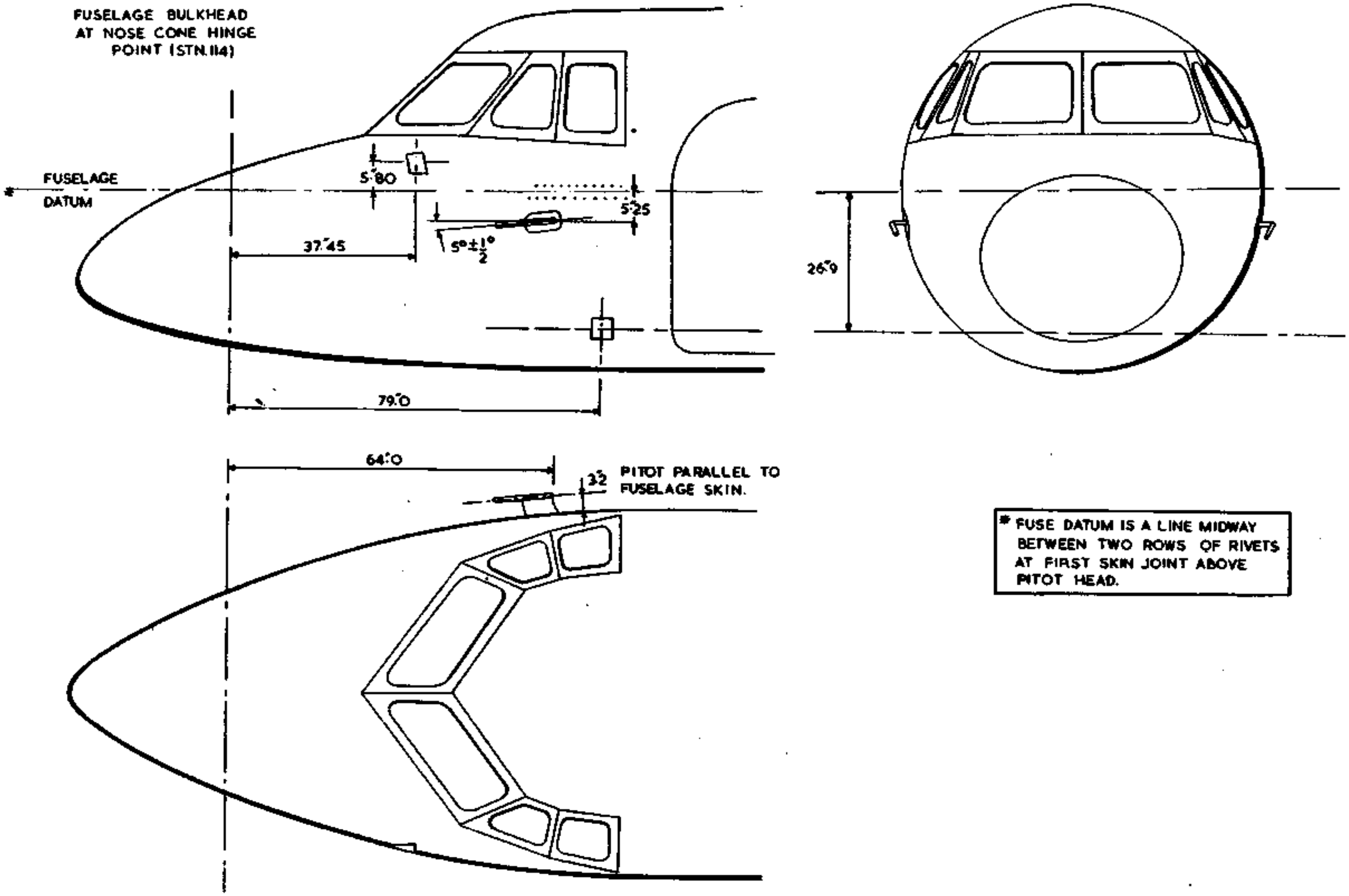

* FUSE DATUM IS A LINE MIDWAY BETWEEN TWO ROWS OF RIVETS AT FIRST SKIN JOINT ABOVE PITOT HEAD.

Pitot head and static plate installation dimensions
Fig.201

50.1

...Pressure head maintenance practices continued

2. Adjustment/Test

A. Insulation resistance test (routine)

(1) Isolate relevant pressure head electrical circuit (Chapter 24 - GENERAL)

(2) Gain access to pressure head terminal block. Remove terminal block cover.

(3) Disconnect electrical cables from terminal block.

(4) Common together the pressure head terminals and, using a 250 volt insulation resistance tester, check that insulation resistance between pressure head body and terminals is not less than 3 megohms.

(5) Disconnect and remove insulation resistance tester and terminals commoning links.

(6) Connect electrical cables to appropriate terminals.

(7) Refit terminal block cover and wire-lock securing screws.

(8) Restore relevant pressure head electrical supplies. Energize relevant d.c. busbar(s) (refer to relevant NAVIGATIONAL AIDS - DESCRIPTION) and check functioning of heaters.

(9) Select the pitot heaters (roof panel) switches off. De-energize relevant busbar(s).

B. Insulation resistance test (head suspected defective)

(1) Effect operations (1) to (6) of para. 2A.

(2) Restore relevant pressure head electrical supply. Energize relevant d.c. busbar(s) (refer to relevant NAVIGATIONAL AIDS - DESCRIPTION). Set relevant PITOT HEADS/MASTS switches to ON and allow pressure head to heat for 10 minutes. Set PITOT HEADS/MASTS switches off.

NOTE: Trip circuit breaker for mast not under test before setting PITOT HEADS/MASTS switches to ON. When either mast heater is being tested, the rudder bias strut heater will be energized.

(3) Effect operations (1), (3) and (4) of para. 2A.

(4) Allow head to cool and check that insulation resistance has not dropped below 3 megohms. Effect operations (5) and (6) of para. 2A.

(5) Refit terminal block cover and wire-lock securing screws.

(6) Restore relevant pressure head electrical supply and check functioning of heaters. Set pitot heaters to off and de-energize busbars.

* * *

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## SINGLE ISOLATION VALVE ASSEMBLY - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove isolation valve and mounting bracket assembly

(1) Remove side panel from right-hand side console to gain access to the rear, single, valve assembly.

(2) Unlock and disconnect static pipes from valve.

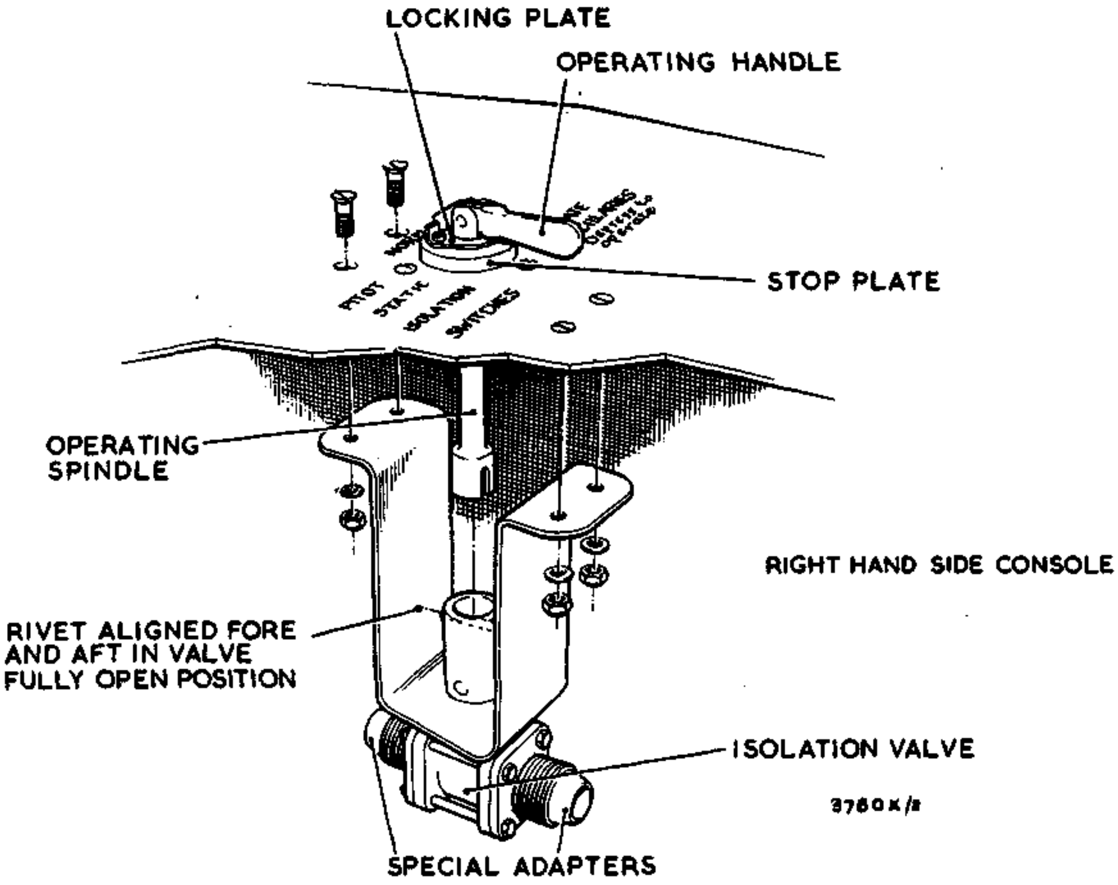
(3) Remove stiffnuts, washers and bolts securing the valve and the valve mounting bracket assembly to the top of the console.

(4) Lower the valve and mounting bracket assembly until the spindle is disengaged from the valve boss. Withdraw assembly from the side console.

NOTE : If the Saunders valve is removed for renewal; remove and retain special adapters for fitment to the new valve.

If it is necessary to remove the operating spindle assembly from the side console :-

(5) Remove stiffnuts, washers and bolts securing the stop plate to the side console, and withdraw spindle assembly.



Single isolation valve installation
Fig. 201

...Single isolation valve assembly - Maintenance practices continued

B. Install isolation valve and mounting bracket assembly

NOTE : If a new Saunders valve is being fitted, the Saunders adapters issued with the new valve must be removed and the correct special adapters (removed from unserviceable valve) fitted in their place.

(1) If applicable, fit operating spindle assembly :- insert operating handle upwards through the aperture. Align holes in stop plate and console, insert bolts and secure from underneath with washers and stiffnuts.

(2) Ensure that operating handle is pointing aft in the NORMAL (open) position.

(3) Move valve boss until the rivet through the top of the boss is aligned in the position as shown on Fig. 201 (valve fully open).

(4) Offer up valve and mounting bracket assembly, and locate valve operating boss onto spindle; ensure that fork on spindle locates over rivet in the boss.

(5) Secure valve to mounting bracket with bolts, washers and stiffnuts.

(6) Turn operating handle and ensure that full and free operation of the valve is achieved. Return handle to its NORMAL (open) position.

(7) Reconnect static pipes and wire-lock.

(8) Suction test static system (see Chapter 34, PITOT/STATIC SYSTEM).

(9) Refit side panel to console.

* * *

## TRIPLE ISOLATION VALVE ASSEMBLY - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove isolation valve

(1) Remove side panel from right-hand side console to gain access to the front triple valve assembly.

(2) Unlock and disconnect pitot and static pipes from valve.

(3) Taking care to retain the pin and spring situated in the rear underside of the handle, tap out the swivel pin. Remove handle from the operating spindle. Tape pin and spring to handle.

(4) Remove stiffnuts, washers and screws securing the stop plate.

(5) With the valve supported, remove stiffnuts, washers and bolts securing the valve to the support bracket panel.

(6) Move valve to clear the support bracket and withdraw valve from console. Blank off exposed pipelines.

NOTE : If a Saunders valve is removed for renewal; remove and retain special adaptors for fitment to new valve.

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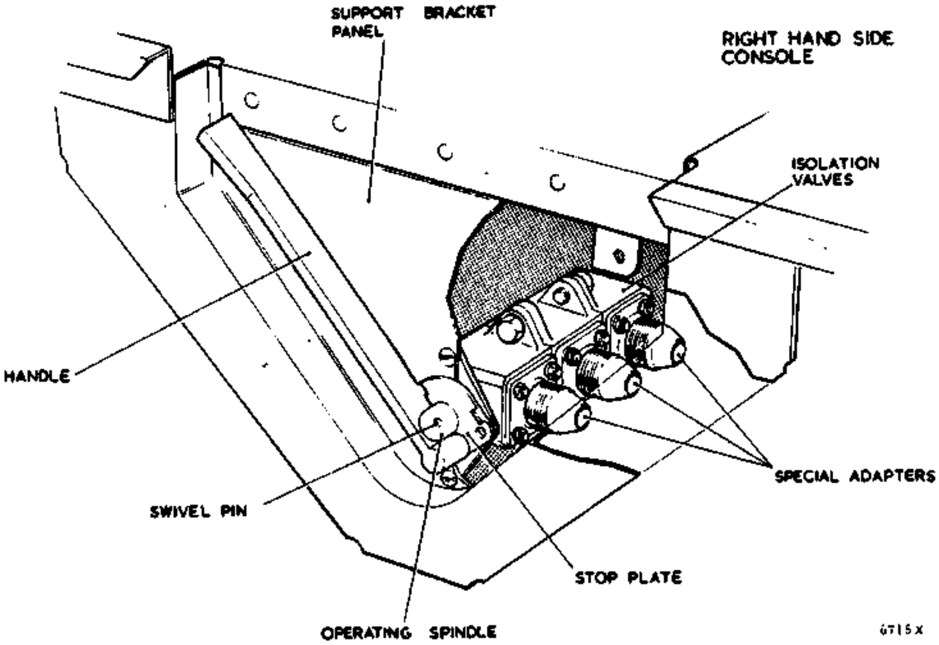

Triple isolation valve installation
Fig. 201

...Triple isolation valve assembly - Maintenance practices continued

B. Install isolation valve

NOTE: If a new Saunders valve is being fitted, the Saunders adaptors issued with the new valve must be removed and the correct special adaptors (removed from unserviceable valve) fitted in their place.

(1) Remove pipeline blanks.

(2) Offer up valve to side console, insert the operating spindle through the orifice in the support bracket panel from the rear, and align holes in the valve flange with holes in the support bracket panel, insert bolts (countersunk bolt in top hole and mushroom head bolt in lower hole), and secure with washers and stiffnuts.

(3) Place stop over operating spindle and secure with screws, washers and stiffnuts.

(4) Insert spring and pin into hole in rear underside of handle. Locate handle in slot in operating spindle and insert swivel pin.

(5) Turn operating handle and ensure that full and free operation of valve is achieved. Return handle to its NORMAL (open) position.

(6) Reconnect pitot and static pipes to appropriate valve unions and wire-lock.

(7) Pressure test pitot system and suction test static system. (See Chapter 34, PITOT/STATIC SYSTEM).

(8) Refit side panel to console.

* * *

## OUTSIDE AIR TEMPERATURE BULB - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove temperature bulb

(1) Isolate outside air temperature electrical circuit, (see Chapter 24, GENERAL).

(2) Disconnect plug and socket assembly.

(3) Unfasten union nut and remove bulb.

#### B. Install temperature bulb

(1) Ensure that locking bush is fitted correctly on bulb stem and that bulb is clean and undamaged.

(2) Thread bulb through mounting orifice and finger tighten union nut.

(3) Position bulb so that probe points forward and is parallel with fuselage fore and aft line, and fully tighten union nut.

(4) Connect and tighten plug and socket assembly; wire-lock.

(5) Restore outside air temperature electrical supply

(6) Energize busbar PE and check that indicator registers outside ambient temperature.

(7) De-energize busbar.

* * *

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# ALTITUDE WARNING SYSTEM (FL 100) - DESCRIPTION AND OPERATION

## 1. General

The altitude warning system comprises an altitude warning unit and either one or two lamps on the main instrument panel. Within the altitude warning unit is a pressure sensing capsule, two relays and a flasher unit.

When PE busbar is energized, both relays are relaxed and the capsule compressed. No supply reaches the flasher unit at this stage unless a lamp is pressed to test the filament(s).

As the aircraft climbs, the capsule expands and, at 10 000ft approx. contacts actuated by the capsule close, operating one relay and switching a supply through to the flasher unit, which provides an intermittent output to the lamp(s). Cancellation of the flasher output is effected by pressing a lamp cap, so energizing the second relay, which routes a hold-on supply to its own coil and cuts the supply input to the flasher unit.

As the aircraft descends from above the 10 000 ft. level, the capsule compresses until, at 10 000 ft. approx. the capsule-operated contacts open, releasing the first relay and routing a supply to the flasher unit, so causing the lamp(s) to flash. Cancellation, again effected by pressing a lamp cap, cuts the hold-on supply to the second relay and the system is thus reverted to the condition at commencement.

* * *

## ALTITUDE WARNING SYSTEM - MAINTENANCE PRACTICES

### 1. Adjustment/Test

#### A. Functionally test altitude warning system

Equipment required :-

Suction test rig capable of producing suction up to 5 lb/sq.in.
Expanding plug adapter BAe 25Y TS 129R/21A
Expanding plug blank BAe 25Y TS 129R/23A

(1) Fit expanding plug blank in vent No.2 on left static vent plate.

(2) Fit expanding plug adapter in vent No.2 on right static vent plate.

(3) Connect hose from suction test rig to expanding plug adapter.

(4) Energize relevant busbar (PE).

(5) Apply suction slowly. Check that the altitude warning lamp flashes at a pressure equivalent to a height of 10 000 ± 500 ft.

(6) Increase the suction to at least the value equivalent to the upper altitude limit. Momentarily press the warning lamp and check that it goes out.

(7) Decrease suction slowly. Check that the altitude lamp flashes at a pressure equivalent to a height of 10 000 ± 500 ft.

(8) Decrease suction to at least the value equivalent to the lower altitude limit. Momentarily press the warning lamp and check that it goes out.

(9) Disconnect and remove suction test rig.

(10) Disconnect and remove expanding plug blank and expanding plug adapter.

(11) De-energize busbar.

* * *

# STALL WARNING SYSTEM - DESCRIPTION AND OPERATION

## 1. General

Stall detection and warning is effected by stall detector units, which sense pitot, static, and vent pressures, and control a stick shaker unit fitted to the left-hand control column.

A detector unit is a sealed case containing two capsule stacks and a relay, air connections S, P and V transmitting static, pitot and vent pressures to the case, first and second capsule stacks respectively.

Each capsule stack controls the position of one of a pair of contacts which 'make' when the ratio of pitot/static pressure differential to vent/static pressure differential reaches a predetermined value. Closure of the capsule-operated contacts energizes the relay and so completes the supply to the stick shaker unit.

Testing of the stick shaker unit is facilitated by the stall warning test switches which, when operated in turn, route a supply direct to the associated detector unit relay.

* * *

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## STALL WARNING SYSTEM - TROUBLE SHOOTING

### 1. General

If stall warning system is suspect; proceed as follows :-

(1) Isolate stall detector electrical circuit, disconnect electrical connections as necessary and carry out continuity tests. If satisfactory reconnect electrical connections and proceed to operation (2)B.

(2) Carry out pressure tests to pipelines as detailed under Pressure test stall warning system in PITOT/STATIC SYSTEM - MAINTENANCE PRACTICES. If pipeline pressure tests are satisfactory proceed as follows :

(a) If stall detector calibration test equipment is available, employ procedure detailed in STALL WARNING SYSTEM - MAINTENANCE PRACTICES to establish stall detector serviceability.

(b) If test equipment is not available, replace suspect stall detector with one of known serviceability.

* * *

## STALL WARNING SYSTEM - MAINTENANCE PRACTICES

### 1. Adjustment/Test

### A. Functional test

Equipment required:-

Pitot/static test set (2 off)

NOTE : A single test set may be used if the pressure outlet is connected using a dual hose assembly containing one isolation valve and one pressure gauge per hose line.

Adapters as specified for PITOT/STATIC SYSTEM - MAINTENANCE PRACTICES.

(1) Ensure pitot/static and stall warning pressure systems are complete.

(2) Connect the pressure outlet of one pitot/static test set to the right hand pitot head, and the pressure outlet of the other pitot/static test set to the right wing stall detector vent.

(3) Ensure that No.2 (Pre Mod.251948) or No.6 (Mod.251948) static vent orifices on each static vent plate are clear of obstruction.

(4) Energize PE busbar (see Chapter 24, GENERAL).

(5) At the pitot head connection, apply sequentially the pressure (P) values given in Table 1 and, in each case slowly increase pressure (V) to the stall detector vent until the stick shaker motor operates. Note vent (V) pressure at each check point.

(6) Check that vent (V) pressures meet requirements of either Table 1 (Pre Mod 251954) or Table 2 (Mod.251954) and then release pressures.

NOTE: Table 1, for switches type 0216-KSB, provides a V/P ratio of 0.67 ± 0.03 on increasing pressure, when checked using mm water.

When A.S.I. gauges (calibrated in knots) are used as alternative to mm water gauge, the readings will not provide the same ratio as mm water to knots conversion is not linear.

TABLE 1 - Check pressures

| | mm water | | knots | |
|---|---|---|---|---|
| | Pitot(P) | Vent(V) | Pitot(P) | Vent(V) |
| 1st check point | 100 | 64-70 | 78 | 62-65 |
| 2nd check point | 150 | 96-105 | 95 | 76-79.5 |
| 3rd check point | 200 | 128-140 | 110 | 88-92 |

NOTE: Table 2, for switches type 0218-KSB, provides a V/P ratio of 0.67 ± 0.02 on increasing pressure, when checked using mm water.

When A.S.I. gauges (calibrated in knots) are used as alternative to mm water gauge, the readings will not provide the same ratio as mm water to knots conversion is not linear.

TABLE 2 - Check pressures

| | mm water | | knots | |
|---|---|---|---|---|
| | Pitot(P) | Vent(V) | Pitot(P) | Vent(V) |
| 1st check point | 100 | 65-69 | 78 | 62.5 - 64.5 |
| 2nd check point | 150 | 97.5-103.5 | 95 | 77 - 79 |
| 3rd check point | 200 | 130-138 | 110 | 88.5 - 91 |

(7) Remove test set connection from pitot head and apply increasing pressure to stall detector vent until stick shaker motor operates. Maintain this vent pressure, reconnect test set to pitot head and apply increasing pressure (P) until warning system cuts out. Check that, at cutout, for switches type 0216 KSB the pressure (P) was between 38.0 and 45.0 mm water (50 ± 2 knots) or for switches type 0218 KSB the pressure (P) was between 76.5 and 86.0 mm water (70 ± 2 knots). Release pressures.

(8) Transfer test set pressure outlet to left wing stall detector vent and repeat operations (5) to (7).

(9) Disconnect and remove test sets.

(10) De-energize busbar.

* * *

## STICK SHAKER UNIT - MAINTENANCE PRACTICES

### 1. Unit servicing

#### A. Service brush gear

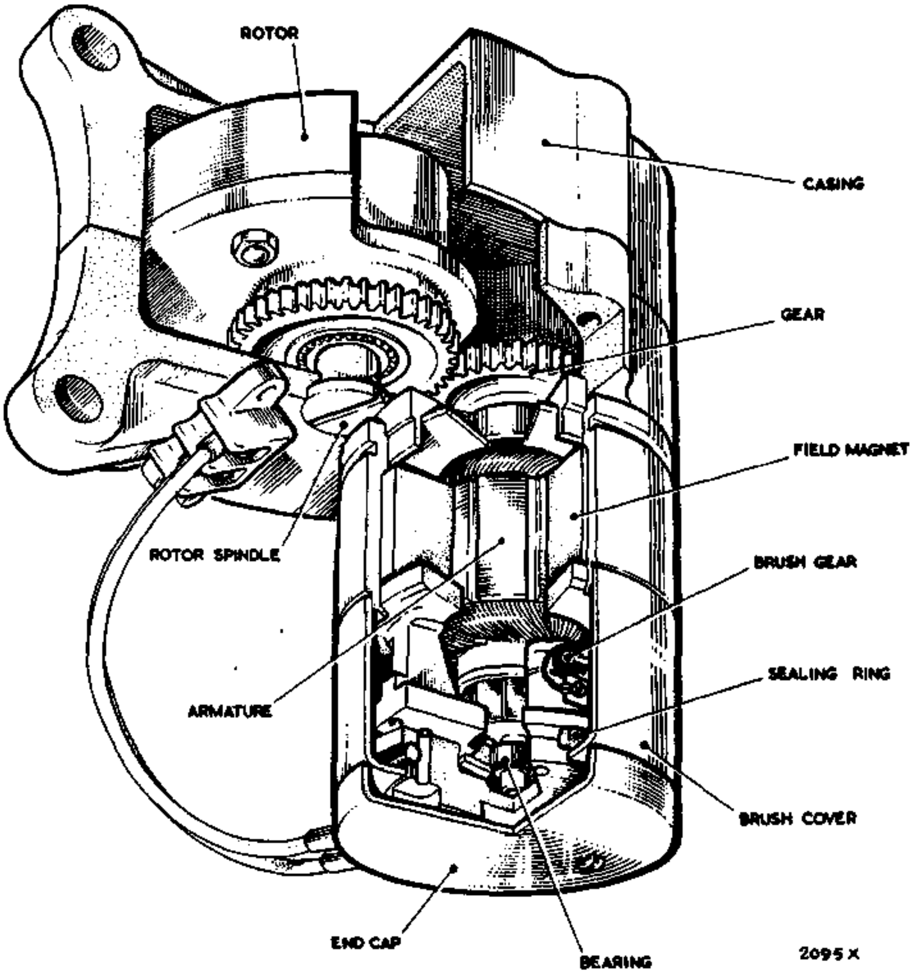
(1) Remove end cap and brush cover from motor and blow out any carbon dust.

(2) Clean commutator with fluff free rag moistened with Toluol and examine for scoring and/or burning. Renew stick shaker unit if commutator is defective.

(3) Check brushes for freedom of movement in boxes and for length. Renew brushes if less than 0.170 in. in length.

NOTE : Instructions on brush renewal are contained in the relevant Overhaul Manual and must be complied with when renewal proves necessary.

(4) Refit brush cover and end cap.



Stick shaker unit
Fig. 201

...Stick shaker unit - Maintenance practices continued

## 2. Removal/Installation

### A. Remove stick shaker unit

(1) Isolate the stick shaker electrical circuit (see Chapter 24, GENERAL).

(2) Disconnect electrical cables from unit terminal block.

(3) Remove stick shaker unit from column.

### B. Checks/Tests before installation

(1) Check that unit is free from signs of mechanical damage, and that terminals are clean and free from corrosion.

(2) Check for free movement of the rotor, by holding the unit in the hands and sharply oscillating it. The rotor must rotate freely.

### C. Install stick shaker unit

(1) Position stick shaker unit on control column, insert and tighten securing bolts.

(2) Connect electrical cables to unit terminals.

(3) Restore the stick shaker electrical supply.

(4) Functionally test the stick shaker unit (para.3A)

## 3. Adjustment/Test

### A. Functionally test stick shaker unit

(1) Energize relevant busbar.

(2) Set stall warning test switch to test position.

(3) Check that the stick shaker unit is energized and vibrates the control column.

(4) Release stall warning test switch.

NOTE : Repeat operations (2), (3) and (4) using alternative stall warning test switch when duplicate detection system fitted.

(5) De-energize busbar.

* * *

# MACH/AIRSPEED AUDIBLE WARNING SYSTEM - DESCRIPTION AND OPERATION

## 1. General

The mach/airspeed audible warning system consists of an electrically operated warning horn which is energized by the mach or airspeed switches (2), or, for test purposes only, a test switch.

The mach and airspeed switches are pressure operated switches which makes an electrical circuit when a preset mach number or airspeed is exceeded. The switch contacts break the circuit when the mach number or airspeed falls below the preset figures.

The audible warning horn is also operated by the landing gear (Chapter 32 - LANDING GEAR - GENERAL) and the cabin depressurization systems (Chapter 21 - PRESSURISATION CONTROL - DESCRIPTION AND OPERATION). The horn gives a continual warning for the landing gear and depressurization systems but an intermittent warning for the mach/airspeed audible warning system.

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## 2. Operation

The mach and airspeed switches contain identical assemblies, an airspeed capsule which responds to the pitot/static differential pressure and an altitude capsule which responds to static pressure only. The airspeed capsule actuates a pair of contacts which make at a preset airspeed. The altitude capsule in conjunction with the airspeed capsule actuates an additional pair of contacts which make at a preset mach number. When either pair of contacts make an internal relay is operated which completes the external electrical circuit. Switches with a mach application only have the airspeed connection omitted and those with an airspeed application only have the mach connection omitted, within their respective units.

The electrical supply to operate the relays, is routed from the external circuit of the mach/airspeed switch, to the energizing coil of one relay, via contacts on a second relay. With the first relay energized, the supply circuit to the horn and to the energizing coil of the second relay is completed. With the second relay energized, the supply circuit to the energizing coil of the first relay is disconnected. This in turn, disconnects the electrical supply to the horn and second relay energizing coil. With the second relay de-energized the supply circuit to the energizing coil of the first relay is completed. This intermittent operation continues all the time maximum operating mach number or permissible indicated airspeed is exceeded.

A capacitor connected across each energizing coil effects a delay on the de-energizing sequence.

The additional airspeed warning switch fitted operates at a lower indicated airspeed when the long range fuel tank contains fuel.

The electrical supply is routed from the low level switch in the long range tank to the main landing gear uplock switch. The uplock switch is closed when the landing gear is down, and thus completes the circuit to the energizing coil of an additional relay. With the relay energized, the electrical supply to the external circuit of the additional airspeed warning switch is completed.

...Mach/airspeed audible warning system - Description and operation continued

This additional relay is connected in such a way as to remain energized after the landing gear has been retracted.

When the long range fuel tank is empty, the low level switch opens, thus disconnecting the elctrical supply to the additional relay. This in turn is de-energized and disconnects the electrical supply to the external circuit of the additional airspeed warning switch.

* * *

## MACH/AIRSPEED AUDIBLE WARNING SYSTEM - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove warning switch

(1) Isolate the mach/airspeed electrical circuit (see Chapter 24, GENERAL).

(2) Remove side panels below pilot's seats and step below control pedestal.

(3) Disconnect electrical connectors from appropriate warning switch.

(4) Disconnect pitot and static pipes from appropriate warning switch. Fit dust caps to switch unit and pipelines.

(5) Remove four screws securing appropriate warning switch to mounting bracket and remove warning switch.

#### B. Install warning switch

(1) Position warning switch on mounting bracket, insert and tighten four securing screws.

(2) Remove dust caps from warning switch and pipelines and connect pitot and static pipelines.

(3) Connect electrical connector to warning switch.

(4) Effect pitot and static system pressure test (see Chapter 34, PITOT/STATIC SYSTEM).

### 2. Adjustment/Test

#### A. Functionally test mach/airspeed warning system

Equipment required :-

Pressure test rig capable of delivering up to 5 lb/sq.in.
Pressure head adapter WIDS 308C.
Suction test rig capable of delivering up to 5 lb/sq.in.
Expanding plug adapter 25Y TS 129R/21A.
Expanding plug blank 25Y TS 129R/23A.

Conversion reading :-

30 000 ft, 3068.3 m.m.WG, 300.9 m.b., 8.89 in.Hg.

(1) Fit expanding plug blank in vent No.6 (No.2 pre Mod.251948) on left static vent plate.

(2) Fit expanding plug adapter in vent No.6 (No.2 pre Mod.251948) on right static vent plate.

(3) Fit pressure head adapter to right-hand pressure head, ensuring that drain holes are completely covered.

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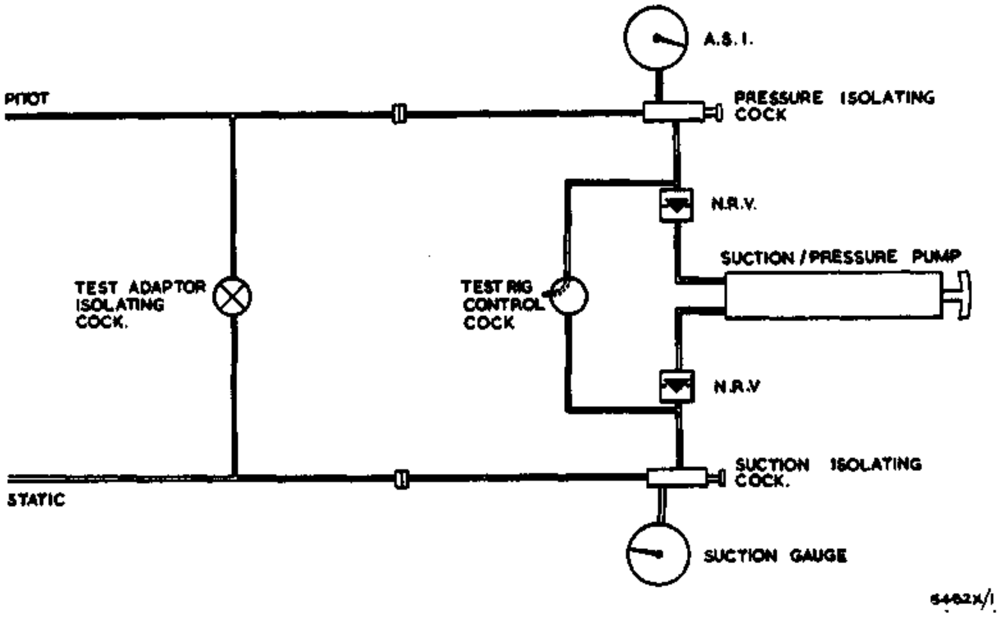
...Mach/airspeed audible warning system - Maintenance practices continued



Suction/pressure test rig
Fig.201

(4) Connect test rig (Fig.201) to pitot and static adapters.

NOTE : If fitted, ensure that isolation valve(s), on the right-hand console, is in the normal (open) position.

(5) Energize relevant busbar (Chapter 24, GENERAL).

(6) Close the test rig pressure isolating cock.

(7) Open test rig suction isolating cock and test adapter isolating cock.

(8) Set test rig control cock to suction and slowly adjust static pressure to 8.89 in.Hg. or equivalent.

(9) Close test rig suction isolating cock and test adapter isolating cock.

(10) Set test rig control cock to pressure.

(11) Open test rig pressure isolating cock and slowly pressurize pitot line until the upper limit for the appropriate mach contracts is obtained (see Table 201); close test rig pressure isolating cock.

(12) Check that warning horn sounds.

(13) Set test rig control cock to suction.

(14) Slowly release test pressure in pitot line by the test rig pressure isolating cock and note that warning horn ceases at the lower limit for the appropriate mach contacts (see Table 201).

...Mach/airspeed audible warning system - Maintenance practices continued

(15) Close test rig pressure isolation cock.

(16) Open test adapter isolating cock. Slowly vent complete system to atmosphere.

(17) Remove expanding plug blank and expanding plug adapter from static vent plates.

(18) Close test adapter isolating cock. Set test rig control cock to pressure.

NOTE : Tests 19 to 21 inclusive to be carried out with L.R. tank full and tank empty.

(19) Open pressure isolating cock and slowly pressurize pitot line until the upper limit for the appropriate airspeed contacts is obtained (see Table 202); close test rig pressure isolating cock.

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### TABLE 201

NOTE : The equivalent airspeed figures for Mach No. are applicable to the test rig only.

| | Mach contact limits | | | |
|---|---|---|---|---|
| Switch Part No. | Ind. Mach No. | | Equivalent knots (30,000 ft) | |
| | Lower | Upper | Lower | Upper |
| 0439/KMB/CP (Mod.25/1741)<br>(Mod.25/2619) | .765 | .775 | 289 | 293 |

### TABLE 202

NOTE : The airspeed figures are applicable to the test rig only.

| Switch Part No. | Airspeed contact limits (knots) | |
|---|---|---|
| | Lower | Upper |
| 0442/KMB/CP (Pre Mod.25/2243) | 260 | 266 Long range tank full |
| 1402/KMB/CP (Pre Mod.25/2243) | 285 | 291 Long range tank empty |
| 0450/KMB/CP (Mod.25/2243)<br>(Mod.25/2619) | 257 | 263 Long range tank full |
| 1412/KMB/CP (Mod.25/2243)<br>(Mod.25/2619) | 282 | 288 Long range tank empty |

(20) Check that warning horn sounds.

(21) Slowly release test pressure in the pitot line by the test adapter isolating cock and note that warning horn ceases at the lower limit for the appropriate airspeed contacts (see Table 202).

(22) Release test pressure. Disconnect test rig and remove adapter from pitot head.

(23) De-energize relevant busbar (Chapter 24 - GENERAL).

(24) If fitted, ensure that isolation valve(s), on the right-hand console is returned to the isolate (closed) position.

* * *

## AILERON SERVO UNIT - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove servo from aileron servo mounting

(1) Isolate autopilot electrical circuits (see Chapter 24, GENERAL).

(2) Remove right-hand pilot's seat (see Chapter 25, CREW SEATS).

(3) Remove plate from top surface of seat mounting.

(4) Disconnect cable connectors at rear of servo.

(5) Loosen servo attachment screws.

(6) Carefully slide servo from servo mounting.

#### B. Checks/Tests before installation (Fig.201)

Special tools and equipment :-

| | |
|---|---|
| Special spanner ... ... ... | 25Y1291 |

(1) Remove servo from transit case.

(2) Apply 27.5 volts d.c. between pins P2-A and P2-B of the servo; this engages electromagnetic clutch in servo.

NOTE : The use of a MS3106A-10SL-3S (Cannon) connector is recommended for safe current application; wire pins A and B of connector.

(3) Lock servo gear train by inserting the shaft of a Philips screwdriver (or suitable rod) through the gear and motor plate hole (Fig.201).

(4) Using a torque spanner fitted with a 5/16 in. A.F. socket, attempt to drive shaft in clockwise or counter-clockwise direction, and check that torque when shaft begins to rotate is 70 lb. in. If necessary, adjust mechanical clutch tension with special spanner; turning the clutch adjusting nut away from the panel (where the connector is located) releases tension on the mechanical clutch.

NOTE : Special spanner 25Y1291 is available from the aircraft manufacturer, or it may be made locally; refer to the associated Collins Automatic Flight Control System Manual for details of the spanner.

(5) Record the surface (AILERON) and torque setting on the servo and servo mounting nameplates.

#### C. Install servo in aileron servo mounting

(1) Smear splined shaft with grease DTD.844, 866 or 5598.

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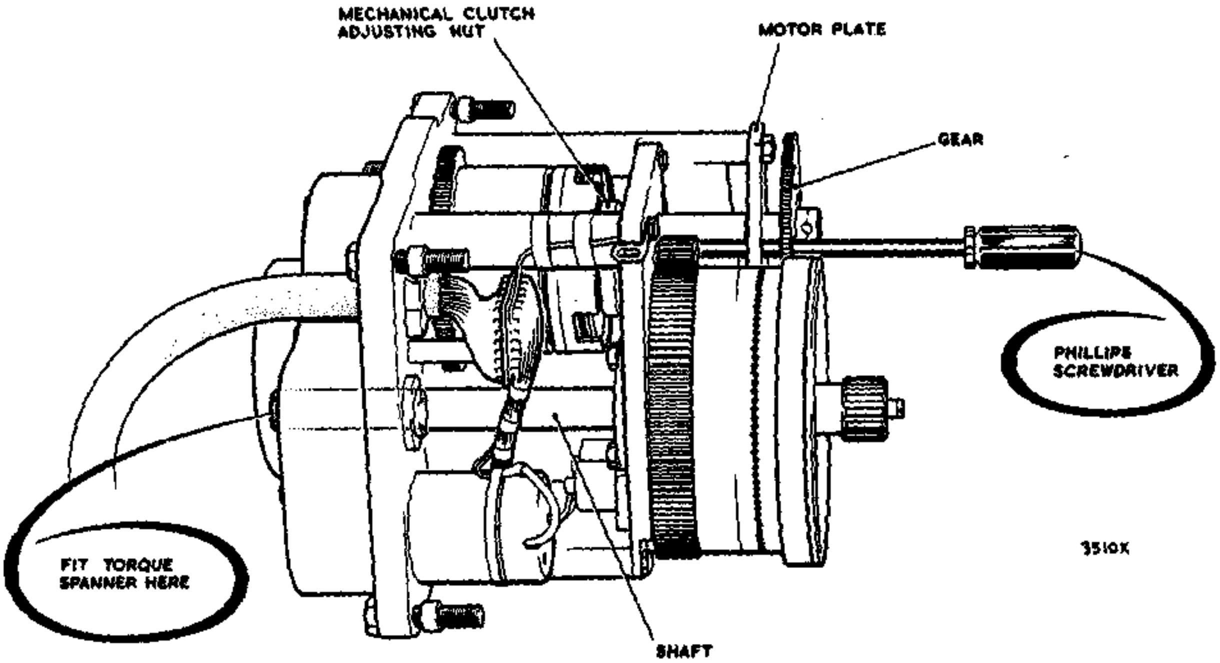
...Aileron servo unit - Maintenance practices continued



Mechanical clutch torque adjustment
Fig.201

(2) Carefully slide servo into servo mounting, making sure that the splined shaft of the engage clutch engages with the capstan internal spline.

(3) Secure servo with attachment screws, and wire-lock screws.

(4) Fit and secure the cable connectors to socket on rear of servo unit.

(5) Carry out a duplicate inspection (see Chapter 27).

(6) Restore autopilot electrical supplies (see Chapter 24).

(7) Carry out the Phasing Tests or channel engagement checks, as appropriate, of relevant AUTOMATIC FLIGHT CONTROL SYSTEM - MAINTENANCE PRACTICES.

(8) Fit plate on top surface of seat mounting and secure with fasteners.

(9) Fit right-hand pilot's seat (see Chapter 25, CREW SEATS).

NOTE : For Removal/Installation of aileron servo mounting, see Chapter 27.

* * *

## RUDDER SERVO UNIT - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove servo from rudder servo mounting

(1) Isolate autopilot electrical circuits (see Chapter 24, GENERAL).

(2) Release toggle fasteners from tail cone and remove tail cone.

(3) Disconnect cable connectors at rear of servo.

(4) Loosen servo attachment screws.

(5) Carefully slide servo from servo mounting.

#### B. Checks/Tests before installation (Fig. 201)

Special tools and equipment :-

Special spanner ... ... ... ... 25Y1291

(1) Remove servo from transit case.

(2) Apply 27.5 volts d.c. between pins P2-A and P2-B of the servo; this engages electromagnetic clutch in servo.

NOTE : The use of a MS3106A-10SL-35 (Cannon) connector is recommended for safe current application; wire pins A and B of connector.

(3) Lock servo gear train by inserting the shaft of a Philips screwdriver (or suitable rod) through the gear and motor plate hole (Fig. 201).

(4) Using a torque spanner fitted with a 5/16 in A.F. socket, attempt to drive shaft in clockwise or counter-clockwise direction, and check that torque when shaft begins to rotate is 125 lb.in. If necessary, adjust mechanical clutch tension with special spanner; turning the clutch adjusting nut away from the panel (where the connector is located) releases tension on the mechanical clutch.

NOTE : Special spanner 25Y1291 is available from the aircraft manufacturer, or it may be made locally; refer to the associated Collins Automatic Flight Control System Manual for details of the spanner.

(5) Record the surface (RUDDER) and torque setting on the servo and servo mounting nameplates.

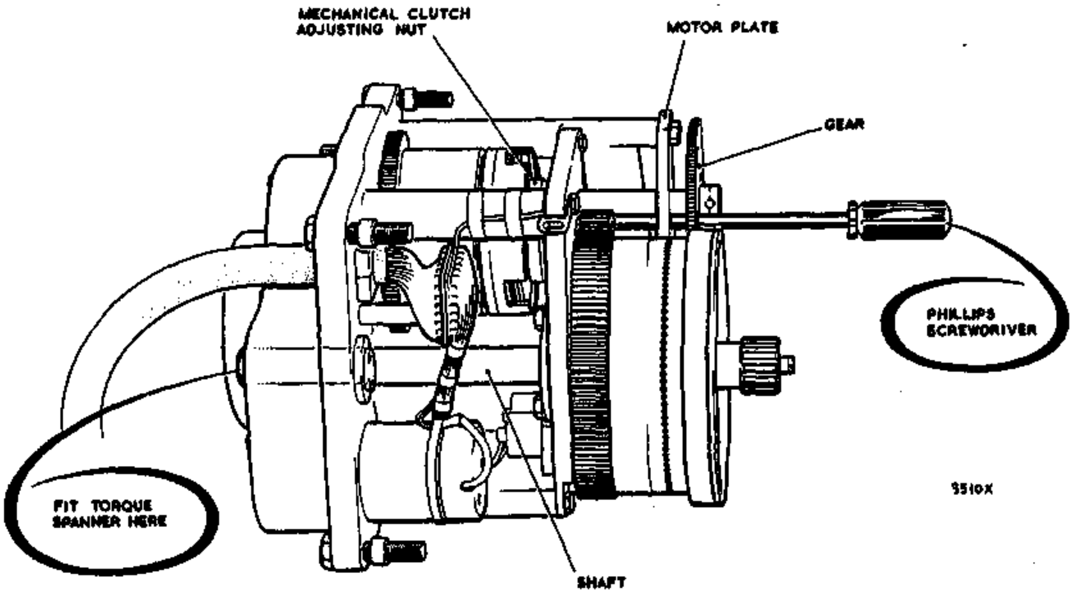
#### C. Install servo in rudder servo mounting

(1) Smear splined shaft with grease DTD 844, 866 or 5598.

(2) Carefully slide servo into servo mounting, making sure that the splined shaft of the engage clutch engages with the capstan internal spline.

(3) Secure with attachment screws and wire-lock screws.

...Rudder servo unit - Maintenance Practices continued



Mechanical clutch torque adjustment
Fig. 201

(4) Fit and secure the cable connectors to socket on rear of servo unit.

(5) Carry out a duplicate inspection (see Chapter 27).

(6) Restore autopilot electrical supplies.

(7) Carry out the Phasing Tests or channel engagement checks, as appropriate, of relevant AUTOMATIC FLIGHT CONTROL SYSTEM - MAINTENANCE PRACTICES.

(8) Fit tail cone and secure with toggle fasteners.

NOTE : For Removal/Installation of rudder servo mounting, see Chapter 27.

* * *

## ELEVATOR SERVO UNIT - MAINTENANCE PRACTICES

### 1. Removal/Installation

A. Remove servo from elevator servo mounting

NOTE : Elevator servo unit is fitted in rear equipment bay.

(1) Isolate autopilot electrical circuits (see Chapter 24 - GENERAL)

(2) Disconnect cable connectors at rear of servo.

(3) Loosen servo attachment screws.

(4) Carefully slide servo from servo mounting.

B. Checks/Tests before installation (Fig.201)

Special tools and equipment :-

| | |
|---|---|
| Special spanner | 25Y1291 |

(1) Remove servo from transit case.

(2) Apply 27.5 volts d.c. between pins P2-A and P2-B of the servo; this engages electromagnetic clutch in servo.

NOTE : The use of a MS3106A-10SL-35 (Cannon) connector is recommended for safe current application; wire pins A and B of connector.

(3) Lock servo gear train by inserting the shaft of a Philips screwdriver (or suitable rod) through the gear and motor plate hole (Fig.201).

(4) Using a torque spanner fitted with a 5/16 in. A.F. socket, attempt to drive shaft in clockwise or counter-clockwise direction, and check that the torque (when shaft begins to rotate) is 95 lb. in. If necessary, adjust mechanical clutch tension with special spanner; turning the clutch adjusting nut away from the panel (where the connector is located) releases tension on the mechanical clutch.

NOTE : Special spanner 25Y1291 is available from the aircraft manufacturer, or it may be made locally; refer to the associated Collins Automatic Flight Control System Manual for details of the spanner.

(5) Record the surface (ELEVATOR) and torque setting on the servo and servo mounting nameplates.

C. Install servo in elevator servo mounting

(1) Smear splined shaft with grease DTD 844, 866 or 5598.

(2) Carefully slide servo into servo mounting, making sure that the splined shaft of the engage clutch engages with the capstan internal spline.

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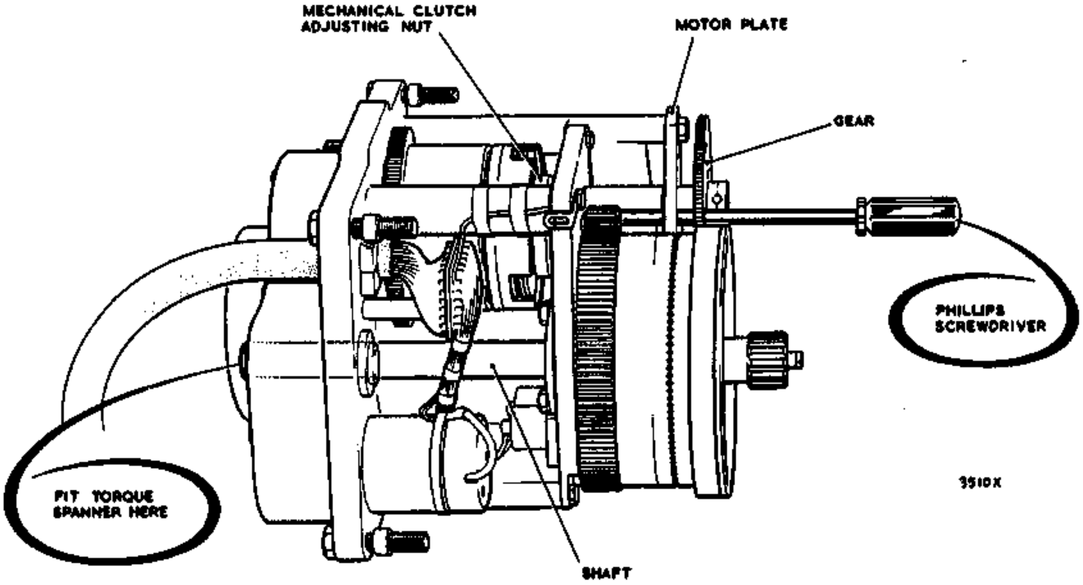
...Elevator servo unit - Maintenance practices continued



Mechanical clutch torque adjustment
Fig. 201

(3) Secure servo with attachment screws and wire-lock screws.

(4) Fit and secure the cable connectors to socket on rear of servo unit.

(5) Carry out a duplicate inspection (see Chapter 27, FLYING CONTROLS).

(6) Restore autopilot electrical supplies.

(7) Carry out the Phasing Tests or channel engagement checks, as appropriate, of relevant AUTOMATIC FLIGHT CONTROL SYSTEM - MAINTENANCE PRACTICES.

NOTE : For Removal/Installation of elevator servo mounting, See Chapter 27.

* * *

## ADF SUPPRESSED SENSE AERIALS - MAINTENANCE PRACTICES

1. Removal/Installation

A. Remove aerial

(1) Isolate both ADF1 and ADF 2 circuits (refer to NAVIGATIONAL AIDS - DESCRIPTION and Chapter 24 - GENERAL).

(2) Remove screws securing glass fibre assembly to dorsal fin fairing.

(3) Lift assembly sufficiently to gain access to aerial leads and bonding lead.

(4) Remove bonding lead to bulkhead and disconnect r.f. cable connectors to equalizer.

B. Install aerial

(1) Position aerial glass fibre assembly on dorsal fin fairing and leave sufficient room to connect r.f. cables and bonding lead.

(2) Connect each r.f. cable connector to its respective equalizer.

(3) Secure bonding lead to bulkhead in aerial assembly.

(4) Position glass fibre assembly, fit and tighten securing screws.

(5) Restore a.d.f. electrical supplies (Chapter 24 - GENERAL).

(6) Functionally test ADF1 and ADF2 systems.

* * *

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# MARCONI SENSE AERIAL SUSCEPTIFORMER - MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Remove susceptiformer

(1) Isolate ADF electrical circuit (see Chapter 24 - GENERAL).

(2) Remove suppressed aerial (see 34-31-672).

(3) Disconnect co-axial cable from susceptiformers.

(4) Remove retaining nuts and bolts and remove susceptiformer

### B. Install susceptiformer

(1) Ensure flange surfaces, earth tags are clean and free from grease and paint.

(2) Fit susceptiformers each side of bulkhead and bolt together ensuring aerial terminals are nearest to appropriate aerial and earth leads are attached by bolts.

(3) Connect co-axial cables.

(4) Connect aerial leads and refit suppressed aerial (see 34-31-672).

(5) Restore ADF electrical circuits, and functionally test.

* * *

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## VOR/LOC SUPPRESSED AERIALS AND BALANCE UNIT - MAINTENANCE PRACTICES

### 1. Removal/Installation

#### A. Remove VOR/LOC aerials and balance unit

(1) Isolate relevant NAV electrical circuits (see Chapter 24 - GENERAL).

(2) Remove nose wheel cover and access panels to aerials.

(3) Remove nuts securing the centre element of the aerial to the matching unit connector strip (Note sequence of assembly).

(4) Remove bolts securing the aerial and glass fibure cover assembly and withdraw assemblies (left and right).

(5) Release clamps securing balance unit cables and remove right-angled cable connectors from balance unit.

**CAUTION :** NOTE ROUTING POSITION OF CO-AXIAL CABLES AND HANDLE CO-AXIAL CABLES CAREFULLY, AVOIDING SHARP BENDS.

(6) Remove bolts securing balance and matching unit assemblies to the aircraft and remove assembly.

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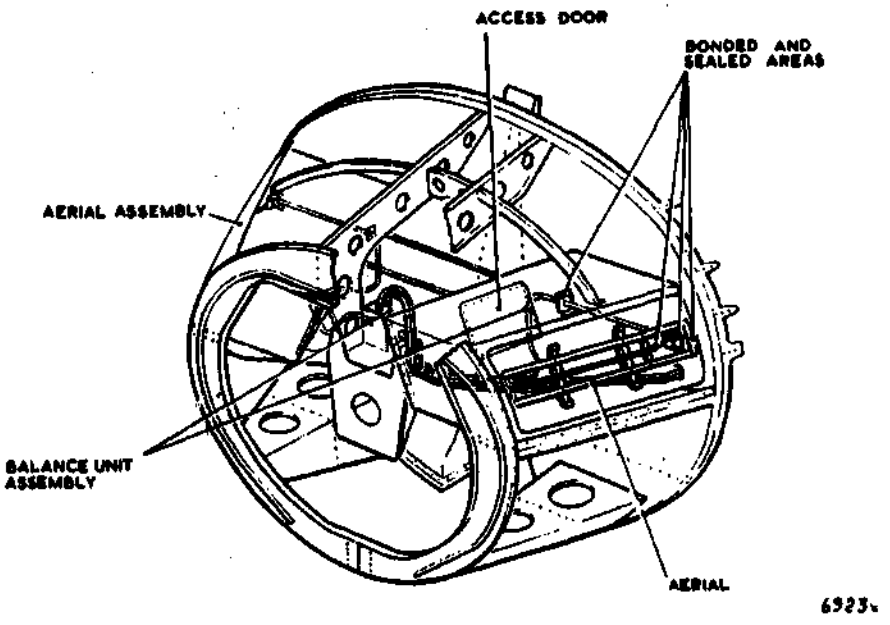

VOR/LOC suppressed aerials installation
Fig.201

B. Install VOR/LOC aerials and balance unit

(1) Clean mating surfaces of balance unit assembly and mountings in the aircraft.

(2) Position the balance unit assembly and secure with bolts. Seal all edges of bonded joints with Thiokol (P.R.1422 - BT2) to DHA.462. Observe CAUTION in A (5) above.

(3) Connect right angled cable connectors to balance unit and fit cable clamps.

(4) Clean connections of the aerial assemblies, mountings in the aircraft and connector of the matching units.

(5) Inspect Thiokol seal around aerial apertures on aircraft. If damaged, clean and renew to a minimum thickness of 0.06 in.

(6) Position the aerial and glass fibre assemblies in their respective apertures, ensuring the aerials are centralized to within ± 0.03 in. and secure with bolts.

CAUTION : ENSURE IN AND OUT OF WIND TOLERANCE OF GLASS FIBRE COVER TO AIRCRAFT IS AS FOLLOWS :-

FORWARD EDGE INTO WIND - NIL
FORWARD EDGE OUT OF WIND - 0.02 in.
AFT EDGE INTO WIND - 0.02 in.
AFT EDGE OUT OF WIND - NIL

(7) Assemble centre element of aerial to matching unit connector strip to the sequence noted in para.A(3) and secure with, nuts.

(8) Repeat operation (7) for the aerial on the opposite side of fuselage.

(9) Seal all bonded connections on aerials (to fuselage and matching unit connections) with Thiokol (P.R.1422 - BT2) to DHA 462.

(10) Fit aerial access doors and nosewheel cover.

(11) Restore relevant NAV electrical circuits.

(12) Functionally test VOR/ILS system, (see Chapter 34, VOR/ILS system).

* * *

## GLIDESLOPE AERIAL - MAINTENANCE PRACTICES

1. Removal/Installation

A. Remove aerial

(1) Isolate VOR/ILS system electrical circuits (Chapter 24 - GENERAL).

(2) Disconnect co-axial connector from aerial.

(3) Remove the aerial attachment bolts and remove aerial.

B. Install aerial

(1) Clean mating surfaces of aerial and aircraft. Fit aerial to mounting and secure with bolts. Seal edge of bonded surfaces with Thiokol PR. 1422 - BT. 2 to DHA 462 (see Chapter 20).

(2) Fit co-axial connector to aerial and tighten fixing ring.

(3) Restore VOR/ILS system electrical circuits.

(4) Functionally test VOR/ILS system (VOR/ILS SYSTEM - MAINTENANCE PRACTICES).

* * *

# CHAPTER

# 35

# OXYGEN

## Chapter 35

## OXYGEN SYSTEM

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+ No separate maintenance practices

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| | | 1400 litres | Walter Kidde WKA37177 |
| | | Charging valve | Damic Controls Ltd. DC550 |
| | | Filter | Walter Kidde WKA32948 |
| * | 35-10-32 | Contents indicator | Walter Kidde WKA29379/1 |
| | | Pressure regulator | Walter Kidde WKA29720/1 |
| | | Pressure regulator | Walter Kidde WKA29720/2 (Mod.253534A) |
| * | 35-10-61 | Master supply valve | Damic Controls Ltd. SDV826/1 or Walter Kidde WKA35831 (Mod.252239) |
| * | 35-10-121 | Demand regulator | ARO 15830E |
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| * | 35-20-12 | Therapeutic outlet | Walter Kidde WKA28905 |
| * | 35-20-31 | Duplex drop-out mask unit | Walter Kidde WKA29607 |
| | | Duplex drop-out mask unit | Walter Kidde WKA33357 (Mod.251765) |
| * | 35-20-42 | Baromatic valve | Walter Kidde WKA28790/3 |
| | | Passenger supply valve | Damic Controls Ltd. SDV826/1 or Walter Kidde WKA35831 (Mod.252239) |
| | | Self-sealing T-piece | Walter Kidde WKA30001 |
| | | Self-sealing outlet | Walter Kidde WKA30462 |
| | | Crew mask | Puritan 11420/11 or Zep Aero 23808-100D |

+ 35-06 OXYGEN SYSTEM (Mod.252036)

| | | | |
|---|---|---|---|
| * | 35-10-14 | Oxygen cylinder assembly 750 litres | Walter Kidde WKA31393/1 (pre-Mod.252729)<br>Walter Kidde WKA37447 (Mod.252729) |
| | | Hose | Walter Kidde WKA34609 |
| | | Charging valve | Damic Controls Ltd. DC550 |
| | | Filter and bursting disc assy | Walter Kidde WKA27942/1 |
| * | 35-10-32 | Contents indicator | Walter Kidde WKA29379/1 |
| * | 35-10-33 | Contents indicator | Walter Kidde WKA29379/1 |
| | | Pressure regulator | Walter Kidde WKA29720/1 |
| | | Pressure regulator | Walter Kidde WKA29720/2 (Mod.253534A) |
| * | 35-10-62 | Master supply valve | Damic Controls Ltd. SDV826/1 or Walter Kidde WKA35831 (Mod.252239) |
| * | 35-10-121 | Demand regulator | ARO 15830E |
| * | 35-10-131 | Quick-release socket | Walter Kidde WKA30912/1 |
| | 35-10-141 | Automatic shut-off valve | Walter Kidde WKA35964/1 |
| * | 35-20-12 | Therapeutic outlet | Walter Kidde WKA28905 |
| | 35-20-31 | Duplex drop-out mask unit | Walter Kidde WKA29607 |
| * | 35-20-42 | Baromatic valve | Walter Kidde WKA28790/3 |
| | | Passenger supply valve | Damic Controls Ltd.SDV826/1 or Walter Kidde WKA35831 (Mod.252239) |
| | | Self-sealing T-piece | Walter Kidde WKA30001 |
| | | Self-sealing outlet | Walter Kidde WKA30462 |
| | | Crew mask | Puritan 114020/11 or Zep Aero 23808-100D |
| | | Therapeutic mask | Walter Kidde WKA30169 |

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# STANDARD OXYGEN SYSTEM - DESCRIPTION AND OPERATION

## 1. Description

This standard oxygen system has been designed to allow for various individual configurations according to customer requirements.

In its normal form, one 1400-litre oxygen cylinder, pressurized to 1800 lb/sq.in., supplies oxygen to two quick-release sockets, in the flight compartment, three duplex drop-out mask units and two therapeutic outlets in the passenger compartment, and one duplex drop-out mask unit in the toilet compartment.

Optional equipment comprises an additional 750-litre oxygen cylinder, a third quick-release socket in the flight compartment, a drop-out mask in the vestibule, and additional duplex drop-out mask units in the passenger cabin.

Cylinder pressure is reduced by a pressure reducing valve to a line pressure of 70 lb/sq.in. Should line pressure rise to 90 lb/sq.in., a relief valve, integral with the reducing valve, bleeds the excess to the cabin.

Supply to the flight compartment quick-release sockets is taken from the pressure reducing valve, each supply being controlled by its own demand regulator. The therapeutic supply is taken direct from the pressure reducing valve.

Supply to the drop-out mask units is controlled by a baromatic valve, pre-set to automatically drop out the masks in the passenger compartment at a cabin altitude of 12 000 ± 500 ft. Manual override of the baromatic valve provides for a similar action, irrespective of cabin altitude.

The oxygen cylinder(s) are located in the nose equipment bay and are charged via a common charging valve also located in the nose equipment bay. An on-off valve on the left-hand console controls oxygen supply from the cylinder to the contents indicator on the left-hand console and to the pressure reducing valve. An on-off valve on the left-hand flight compartment bulkhead controls oxygen supply from the baromatic valve to the duplex drop-out mask units. An in-line filter is fitted downstream of the oxygen cylinder(s) in the nose equipment bay.

## 2. Pipes and fittings

With the exception of the hoses which connect the duplex drop-out mask units to the supply line, and the hoses from the demand regulators to the quick-release sockets, all system piping is of stainless steel, tungum, or light alloy. The pipe connections are standard AGS fittings, other than the self-sealing T-connections feeding each drop-out unit, the in-line self-sealing connections feeding the toilet compartment drop-out unit, and the therapeutic outlets.

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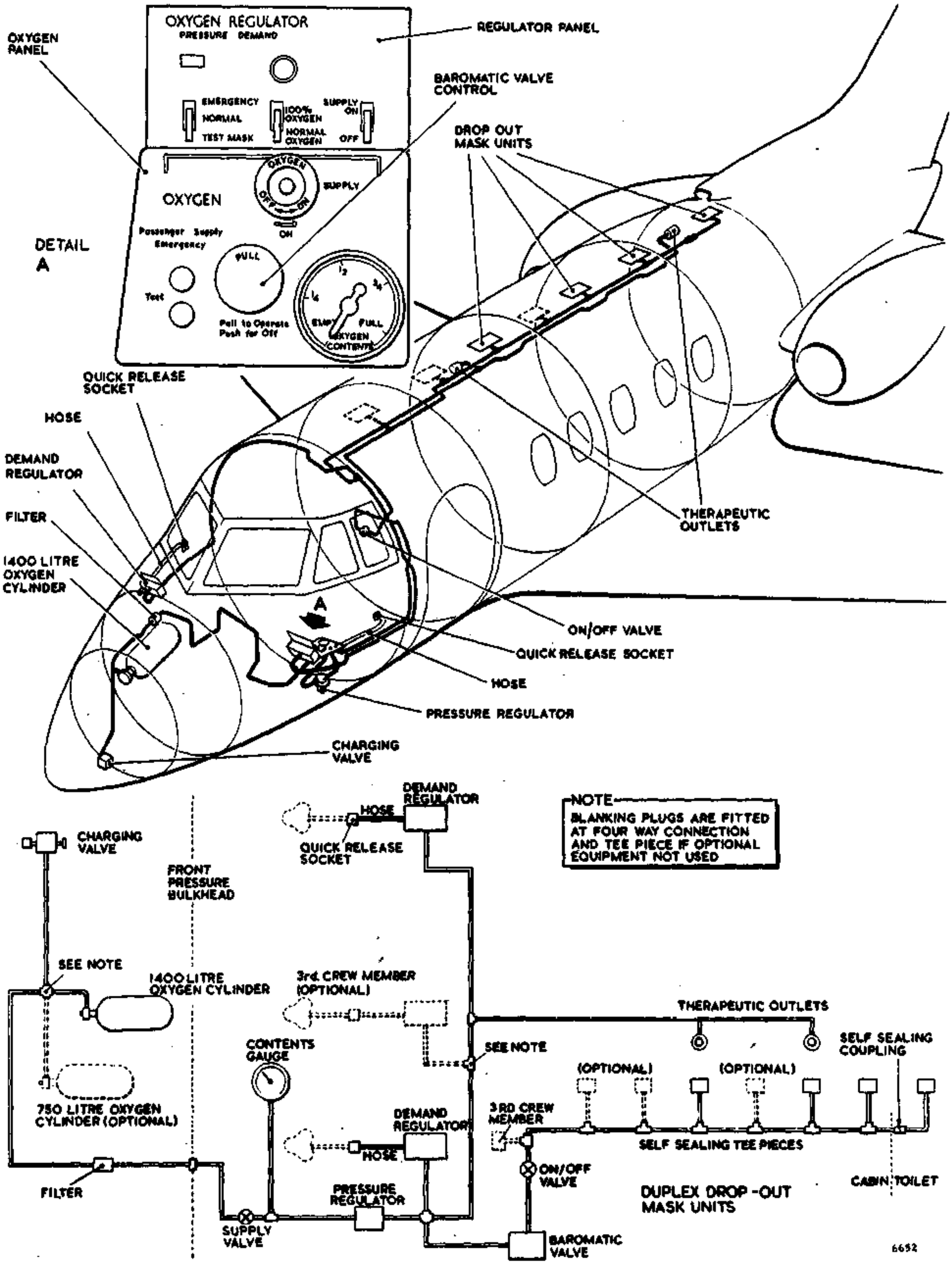

Oxygen system
Fig. 1

## 3. Operation

### A. General

Oxygen from the storage cylinders is fed to the SUPPLY valve on the oxygen panel on the left-hand console. Opening the SUPPLY valve permits oxygen to flow to the contents indicator and to the pressure reducing valve, and then, at reduced pressure, to each demand regulator, the baromatic valve and therapeutic outlet.

### B. Crew supply

Under normal flight conditions where oxygen is required, with the regulator SUPPLY switches set to ON and NORMAL OXYGEN, diluted oxygen is supplied to the crew member's mask throughout the inspiratory phase. The amount of dilution is controlled by the regulator aneroid and the ratio of air/oxygen is decreased with increase in cabin altitude; above approximately 32 000 feet, 100% oxygen is supplied to the mask.

With the regulator SUPPLY switches set to ON and 100% OXYGEN, the regulator aneroid valve is inoperative and 100% oxygen, irrespective of cabin altitude, is supplied to the mask, throughout the inspiratory phase.

With the emergency switch of the regulator set to EMERGENCY or ON, 100% oxygen is supplied to the mask throughout the inspiratory and expiratory phases at a positive pressure which prevents any inward leakage at the mask.

### C. Passenger supply

Whilst the cabin altitude is maintained below 12 000 + 500 feet, the baromatic valve remains closed. When the cabin altitude rises above 12 000 ± 500 feet the baromatic valve opens automatically and supplies oxygen to the passenger system on/off valve, which is normally 'on', and thence to the duplex drop-out mask units. The oxygen pressure operates the lid release mechanism of each drop-out unit and allows the masks to fall to the 'half-hang' position. In this position, oxygen flow to the mask is prevented by a check valve held closed by a clip in the box of the mask unit; oxygen flow to the mask is initiated by removing the check valve from the clip. Flow to the mask, shown by an indicator incorporated with the check valve, can be cut off by re-inserting the check valve in its clip.

If required, the baromatic valve can be operated manually by the left-hand pilot, irrespective of cabin altitude. The drop-out units operate as previously described.

### D. Therapeutic supply

Oxygen for therapeutic use is available at two self-sealing outlets in the passenger cabin. These outlets incorporate a check valve, spring loaded against its sealing and sealed by two sealing rings. When the bayonet adapter of a therapeutic mask hose is inserted, the hollow probe of the bayonet adapter unseats the check valve and enters the sealing rings. Oxygen then flows through the hollow probe to the mask, leakage past the probe being prevented by the sealing rings. Oxygen flow to the mask is shown by an indicator integral with the mask hose.

* * *

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## STANDARD OXYGEN SYSTEM - TROUBLE SHOOTING

| Item | Fault | Possible cause | Remedy |
|---|---|---|---|
| (1) | No pressure registered on indicator when master on/off valve opened. | (a) Cylinder stop-valves not open.<br>(b) Cylinders empty<br>(c) Indicator defective | (a) Open cylinder stop-valves and wire-lock in open position<br>(b) Recharge cylinders.<br>(c) Fit new indicator |
| (2) | No pressure available at demand regulators or therapeutic outlets | Pressure reducing valve defective | Fit new pressure reducing valve. |
| (3) | No pressure available at any one demand regulator | Demand regulator defective | Fit new demand regulator |
| (4) | Drop-out mask units fail to operate when baromatic valve is operated | (a) Passenger supply valve not open<br>(b) Baromatic valve defective | (a) Open passenger supply valve<br>(b) Fit new baromatic valve |
| (5) | Any one drop out mask unit fails to operate when baromatic valve is operated | (a) Drop out unit lid release sticking<br>(b) Masks incorrectly stowed<br>(c) Drop-out unit defective | (a) Check operation of lid release unit for freedom of action<br>(b) Stow correctly and re-check<br>(c) Fit new drop out unit |
| (6) | Pressure drop indicated on contents indicator when master supply valve is closed,demand regulators are shut off, baromatic valve is shut. | Leak at pipeline unions to, or in components as follows :- contents gauge, pressure reducing valve, demand regulator(s) baromatic valve, therapeutic outlets. | Check pipelines and tighten unions. If leaks at unions persist, close stop valves on oxygen cylinders, disconnect suspect union and examine pipe belling. Renew pipe or component as necessary. |
| (7) | No pressure drop at condition (6) followed by indicated pressure drop when baromatic valve is operated, passenger supply valve shut. | (a) Leak in pipeline or unions between baromatic valve and supply valve<br>(b) Passenger supply valve defective. | (a) Check pipeline and tighten unions. If leaks persist, proceed as in (6) above<br>(b) Fit new valve |

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...Standard oxygen system - Trouble shooting continued

| Item | Faulty | Possible cause | Remedy |
|---|---|---|---|
| (8) | No pressure drop at condition (6) followed by indicated pressure drop when any one demand regulator supply switch is ON. | Internal leak in regulator | Fit new regulator |
| (9) | No pressure drop at condition (7) followed by pressure drop when passenger supply valve is opened. | Leak in pipelines or unions downstream of supply valve or at duplex drop out units, or self-sealing T-pieces where drop out units not fitted. | Check pipelines and tighten unions. If leaks persist, proceed as in (6) above.<br>Check self-sealing outlets. Renew defective items<br>Check drop out mask units. Renew defective items. |
| (10) | Cylinder leaks | Defective stop valve assembly. | Refer to vendor manual. |
| (11) | Charging valve leaks | Defective charging valve | Fit new valve |
| (12) | Little or no oxygen available at crew mask with flow indicated on demand regulator flow indicator. | (a) Leak at hose connections at regulator and/or socket<br>(b) Leak at mask plug and socket connection | (a) Tighten connections. If leak continues, fit new hose.<br>(b) Fit new plug and/or socket as necessary. |

* * *

## STANDARD OXYGEN SYSTEM - MAINTENANCE PRACTICES

WARNING: OIL OR GREASE IN CONTACT WITH OXYGEN FORMS AN EXPLOSIVE MIXTURE. ALL SERVICING AND MAINTENANCE MUST BE EFFECTED WITH DEGREASED TOOLS AND CLEAN HANDS.

### 1. Servicing

See Chapter 12, OXYGEN, for servicing instructions.

### 2. Removal/Installation

Materials required:

| | |
|---|---|
| Anti-seize compound ... ... ... ... | Rectorseal 15 (MIL-T-5542D) |
| Degreasing fluid ... ... ... ... | Trichloroethane or Genklene |

### A. Remove pipes and fittings

When disconnecting any part of the oxygen system, effect the following :-

(1) Isolate the oxygen supply at the cylinder stop valve when making any disconnection upstream of the master SUPPLY valve.

(2) Isolate the oxygen supply at the master SUPPLY valve when making any disconnection downstream of the SUPPLY master valve.

(3) Fit blanks to all pipes, fittings and components affected by disconnection.

### B. Checks/Tests before installation

When fitting a new pipe, effect the following :-

(1) Blow through pipe with clean dry compressed air.

(2) Pass clean warm degreasing fluid through the pipe until the used fluid appears colourless, then wash through at least twice more with clean warm degreasing fluid.

(3) Wash through pipe with boiling water, followed by a thorough flushing with demineralized or distilled water.

(4) Blow through pipe with clean dry air obtained from a compressed air cylinder, or nitrogen.

(5) Unless pipe is to be fitted immediately into oxygen system, blank-off pipe ends with metal blanks.

(6) On installation, lightly smear the male threads only of pipe and component connectors with anti-seize compound; the minimum amount must be applied to ensure no excess is exuded into the bores of pipes or components.

...Standard oxygen system - Maintenance practices continued

### C. Install pipes and fittings

After installing any part of the oxygen system, effect the following:-

(1) Leak test, clean and dry all connections re-made in any installation procedure; refer to para.3 for details.

(2) On satisfactory completion of test, ensure that all connections are secure and, where applicable, wire-locked.

(3) Ensure that oxygen cylinder stop valve is wire-locked in the open position.

## 3. Adjustment/Test

Equipment and materials required :

Suction unit and altimeter - TS.251R1A
Test adapter and hose (therapeutic outlets) - WKA 32342 (W. Kidde).
Flowmeter calibrated to at least 4 litres/min.
Leak testing solution - 5% Nonidet P40 to 95% distilled water

### A. Pressure and leak tests

(1) Ensure oxygen cylinder is fully charged (see Chapter 12, SERVICING - OXYGEN), and cylinder stop valve is shut.

(2) Close the master SUPPLY valve and disconnect the valve outlet pipe.

(3) Turn on the cylinder stop valve. Check that there is no leakage across the SUPPLY valve.

(4) Reconnect the SUPPLY valve outlet pipe.

(5) Disconnect the outlet pipe from the baromatic valve, and check that the SUPPLY switch of each demand regulator is in the OFF position.

(6) Turn the master SUPPLY valve on. Check that the contents indicator registers full, and that there is no leakage across the baromatic valve.

(7) Reconnect the baromatic valve outlet pipe.

(8) Ensure that passenger supply valve is shut, then disconnect outlet pipe from valve.

(9) Manually operate baromatic valve to open position. Check that there is no leakage across the passenger supply valve. Check reading on contents indicator then shut master SUPPLY valve. Check reading on contents indicator - there should be no drop. Reconnect passenger supply valve outlet pipe.

...Standard oxygen system - Maintenance practices continued

(10) Leave system state as in (9) for one hour. There should be no loss of pressure, indicated by drop in contents indicator reading. If loss of pressure is indicated trace leak using leak testing solution. Thoroughly dry connections after leak test.

(11) Reset baromatic valve by pushing reset knob fully inward, then allowing knob to return to the inner detent position.

B. Flow test at crew outlets

(1) Ensure oxygen cylinder is fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valve is open.

(2) Turn the master SUPPLY valve on.

(3) Plug mask hose into quick-release socket and fit mask over face.

(4) Select demand regulator oxygen SUPPLY switch to ON and flow switch to NORMAL, and check that there is no restriction to breathing and that oxygen flow is registered on the flow indicator during inhalation only.

(5) Select flow switch to 100%, and check that there is no restriction to breathing and that oxygen flow is registered during inhalation only.

(6) Select emergency switch to ON or EMERGENCY, and if applicable, to TEST MASK and check that there is no restriction to breathing and that oxygen flow is registered continuously throughout breathing cycle in each position.

(7) Select emergency switch to OFF or NORMAL, flow switch to NORMAL, and SUPPLY switch to OFF.

(8) Remove mask from face and unplug mask hose from socket.

C. Flow test at passenger drop-out units

(1) Ensure oxygen cylinder is fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valve is open.

(2) Turn the master SUPPLY valve on.

(3) Turn passenger supply valve on.

(4) Pull baromatic valve reset knob to the outer detent position and check that all drop-out mask stowages have opened and all masks are in the 'half-hang' position.

(5) Check that there is no leakage from any mask in the 'half-hang' position.

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(6) At each mask in turn, remove the check valve from its clip and check that the flow indicator in the valve is spinning, and that with the mask over the face there is no restriction to breathing. Using a flowmeter, check that the flow is 3.4 + 0.2 litres/min. (pre Mod.25/1765) or 3.9 ± 0.2 litres/min. (Mod.25/1765).

(7) Reset baromatic valve by pushing reset knob fully inward, then allowing knob to return to the inner detent position. Turn the passenger supply valve off.

(8) At each drop-out unit in turn, re-fit check valves into their respective clips, fold and stow each mask.

(9) Turn the master SUPPLY valve off.

D. Flow test at therapeutic outlets

(1) Ensure oxygen cylinder is fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valve is open.

(2) Turn the master SUPPLY valve on.

(3) Connect the flowmeter to the test adapter hose and plug in adapter to each therapeutic outlet in turn and check that a flowmeter reading of 4 ± 0.3 litres/min. is obtained.

(4) Disconnect flowmeter from adapter hose.

(5) Turn the master SUPPLY valve off.

E. Test automatic operation of baromatic valve

(1) Ensure oxygen cylinder is fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valve open.

(2) Turn the master SUPPLY valve on.

(3) Turn the passenger supply valve on.

(4) Connect suction unit and altimeter to the baromatic valve test points on the oxygen panel.

(5) Slowly apply suction; check that baromatic valve operates and that all drop-out mask units operate at an indicated altitude of 12 000 ± 500 feet.

(6) Slowly release suction; when ground level altitude is indicated on test altimeter, remove suction unit and altimeter.

(7) Reset baromatic valve by pushing reset knob fully inward, then allowing knob to return to inner detent position.

...Standard oxygen system - Maintenance practices continued

(8) Turn the passenger supply valve off.

(9) Turn the master SUPPLY valve off.

* * *

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# OXYGEN SYSTEM - DESCRIPTION AND OPERATION
(Mod.25/2036)

## 1. Description

Two 750 litre oxygen cylinders (with provision for a third 750 litre cylinder) are mounted in the rear equipment bay between frames 24 and 25. The cylinders are charged to 1800 p.s.i. and normally supply oxygen to two quick-release sockets in the flight compartment, to two therapeutic outlets and four drop-out mask units in the passenger compartment, and one drop-out mask unit in the toilet. Provision is made to fit a regulator and quick-release socket in the forward vestibule cabinet for a third crew member, a drop-out mask in the vestibule, and for additional drop-out mask units in the passenger compartment depending on the number of seats.

Cylinder pressure is reduced to a nominal of 70 p.s.i. by a pressure regulator incorporating a relief valve which operates at 90 p.s.i. Aircraft Post-Mod. 253534A have a pressure regulator with revised earthing arrangements to improve the electrical bonding. The pressure regulator has an integral earth lug which attaches two bonding leads to the adjacent system piping.

The supply for the crew masks at the quick-release sockets is taken from the pressure regulator through a separate demand regulator for each socket. The supply for the therapeutic outlets is taken directly from the pressure regulator.

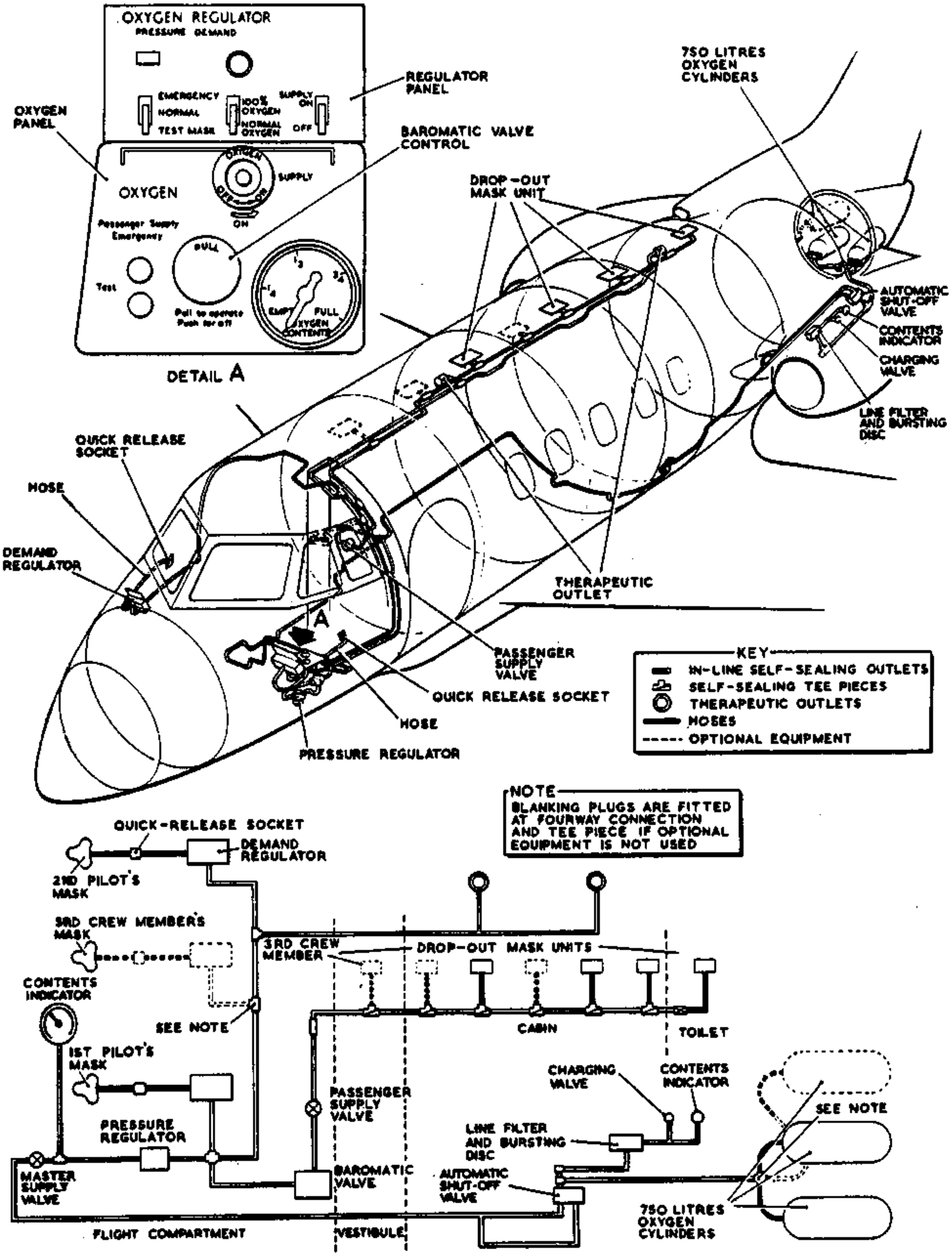
The drop-out masks supply is taken from the pressure regulator via a baromatic valve and the passenger supply valve. The baromatic valve automatically causes the masks to fall to the 'half-hang' position at a cabin altitude of 12 000 ± 500 feet and can be operated manually to release the masks at any altitude.

The oxygen cylinders are charged at a charging valve in the LH fairing of the ventral fuel tank; a contents indicator is mounted adjacent to the charging valve. The charging supply passes through a line filter and bursting disc assembly before joining the pipeline from the cylinders to the automatic shut-off valve.

The automatic shut-off valve is located outside of the fuselage beneath the rear fuselage fairing panel aft of the oxygen charging panel. The valve is provided to shut off the oxygen supply should there be a rupture of the supply pipeline downstream of the valve in the area subject to engine debris if an engine breaks up.

## 2. Pipes and fittings

All system piping is of stainless steel or light alloy, except for hoses which connect the oxygen cylinders and drop-out mask units to the supply, the hoses between the demand regulators and quick-release sockets. Pipe connections are standard fittings except for the self-sealing T-pieces and the self-sealing outlets to the drop-out mask units and the therapeutic outlets. The hoses from the oxygen cylinders are fitted with screen tubes which are attached to the cylinders and a sealed box surrounding the 4-way piece. The sealed box is vented to atmosphere.



Oxygen system
Fig.1

## 3. Operation

### A. General

Oxygen from the storage cylinders is fed to the SUPPLY valve on the oxygen panel on the left-hand console. Opening the SUPPLY valve permits oxygen to flow to the contents indicator and the pressure regulator, then, at 70 lb/sq.in., to the demand regulators, therapeutic outlets, and the baromatic valve.

### B. Crew supply

When oxygen is required under normal flight conditions, the regulator switches are set to ON and NORMAL OXYGEN; diluted oxygen is then supplied to the mask during inhalation. The ratio of air/oxygen decreases with an increase in cabin altitude until 100% oxygen is supplied above 32 000 feet. Above approximately 27 000 feet a positive pressure is built up at the regulator outlet, thus obtaining automatic safety pressure and pressure breathing above 30 000 feet, which assists breathing and prevents inward leakage at the mask.

With the regulator switches set to ON and 100% OXYGEN, undiluted oxygen is supplied to the mask during inhalation, irrespective of cabin altitude.

With the emergency/test switch set to EMERGENCY, 100% oxygen is supplied to the mask at a positive pressure during inhalation and exhalation, thus preventing any inward leakage at the mask.

### C. Passenger supply

While the cabin altitude is below 12 000 ± 500 feet, the baromatic valve remains closed. If the cabin altitude rises above 12 000 ± 500 feet, the baromatic valve opens automatically and supplies oxygen to the passenger supply valve, which is normally on, and then to the drop-out mask units. The oxygen pressure operates the lid release mechanism of each mask unit and allows the masks to fall to the 'half-hang' position; in this position oxygen flow to the mask is prevented by a check valve which is held closed by the stowage clip in the box. When the mask is donned, the check valve is pulled from the clip and oxygen flows to the mask as shown by an indicator integral with the check valve. Flow to the mask can be cut-off by re-inserting the check valve in its clip.

The drop-out masks can be released to the 'half-hang' position by the manual operation of the baromatic valve, irrespective of altitude.

### D. Therapeutic supply

Oxygen for therapeutic use is available at two self-sealing outlets in the passenger cabin. These outlets incorporate a check valve, spring-loaded against its seating and sealed by two sealing rings. When the bayonet adapter of the therapeutic mask is inserted, the hollow probe of the adapter unseats the check valve and enters the sealing rings. Oxygen then flows to the mask as shown by an indicator integral with the mask hose.

* * *

## OXYGEN SYSTEM - TROUBLE SHOOTING

| Item | Fault | Possible cause | Remedy |
|---|---|---|---|
| 1 | No pressure shown on cockpit indicator when master supply valve ON. | (a) Cylinder stop-valves not open.<br>(b) Cylinders empty.<br>(c) Indicator defective (compare with charging indicator). | (a) Open cylinder stop-valves and wire-lock in open position.<br>(b) Replenish cylinders.<br>(c) Renew indicator. |
| 2 | No supply from demand regulators or therapeutic outlets. | Pressure regulator defective. | Renew pressure regulator. |
| 3 | No supply from any one demand regulator. | Demand regulator defective. | Renew demand regulator. |
| 4 | All drop-out mask units fail to release when baromatic valve is operated. | (a) Passenger supply valve not open.<br>(b) Baromatic valve defective. | (a) Open passenger supply valve.<br>(b) Renew baromatic valve. |
| 5 | Any one drop-out mask units fails to release when baromatic valve is operated. | (a) Drop-out lid release sticking.<br>(b) Masks incorrectly stowed.<br>(c) Drop-out unit defective. | (a) Check operation of lid release unit for freedom of action.<br>(b) Stow correctly and check operation.<br>(c) Renew drop-out unit. |
| 6 | Pressure drop indicated on charging contents indicator when master supply valve is OFF. | Leak at pipeline unions to, or in cylinder stop valves, charging valve, bursting disc assembly. | Check pipelines and tighten unions. If leaks at unions persist, close stop valves, disconnect suspect union and examine pipe belling. Renew pipe or component as necessary. |
| 7 | Pressure drop indicated on cockpit contents indicator when master supply valve is OFF, demand regulators are OFF, and baromatic valve is shut. | Leak at pipeline unions to, or in contents gauge, pressure regulator, demand regulators, baromatic valve, therapeutic outlets. | Check pipelines and tighten unions. If leaks persist, see (6). |

continued

...Oxygen system - Trouble shooting continued

| Item | Fault | Possible cause | Remedy |
|---|---|---|---|
| 8 | No pressure drop at condition (7) but pressure drop when baromatic valve is open with passenger supply valve OFF. | (a) Leak in pipelines or unions between baromatic valve and supply valve.<br>(b) Passenger supply valve leaking. | (a) Check pipelines and tighten unions. If leak persists, see (6).<br>(b) Renew valve. |
| 9 | No pressure drop at condition (7) but pressure drop if any one demand regulator is ON. | Internal leak in regulator. | Renew regulator. |
| 10 | No pressure drop at condition (8), but pressure drop when passenger supply valve is ON. | Leak in pipelines or unions downstream of valve, or at drop-out mask units, or unused self-sealing outlets. | Check pipelines and tighten unions. If leaks persist, see (6). |
| 11 | Cylinder leaks. | Defective stop valve. | See vendor manual. |
| 12 | Charging valve leaks | Defective charging valve. | Renew valve. |
| 13 | Little or no oxygen available at crew mask with flow indicated on demand regulator flow indicator. | (a) Leak at hose connections at regulator and/or socket.<br>(b) Leak at mask plug and socket connection. | (a) Tighten hose clips; if leak persists, renew hose.<br>(b) Renew plug and/or socket. |

# OXYGEN SYSTEM - MAINTENANCE PRACTICES

WARNING: OIL OR GREASE IN CONTACT WITH OXYGEN FORMS AN EXPLOSIVE MIXTURE. ALL SERVICING AND MAINTENANCE MUST BE EFFECTED WITH DEGREASED TOOLS AND CLEAN HANDS.

## 1. Servicing

See Chapter 12, OXYGEN, for servicing instructions.

## 2. Removal/Installation

Materials required:

| | |
|---|---|
| Anti-seize compound ... ... ... ... | Rectorseal 15 (MIL-T-5542D) |
| Degreasing fluid ... ... ... ... | Trichloroethane or Genklene |
| Flushing fluid ... .... ... ... | Demineralized or distilled water |

### A. Remove pipes and fittings

When disconnecting any part of the oxygen system, effect the following:-

(1) Isolate the oxygen supply at the cylinder stop valves when making any disconnections upstream of the master SUPPLY valve.

(2) Isolate the oxygen supply at the master SUPPLY valve when making any disconnection downstream of the supply master valve.

(3) Fit blanks to all pipes, fittings and components affected by disconnection.

### B. Checks/Tests before installation

When fitting a new pipe, effect the following:-

(1) Blow through pipe with clean dry compressed air.

(2) Pass clean warm degreasing fluid through the pipe until the used fluid appears colourless, then wash through at least twice more with clean warm degreasing fluid.

(3) Wash through pipe with boiling water, followed by a thorough flushing.

(4) Blow through pipe with clean dry air obtained from a compressed air cylinder, or nitrogen.

(5) Unless pipe is to be fitted immediately into oxygen system, blank off pipe ends, with metal blanks.

(6) On installation, lightly smear the male threads only of pipe and component connectors with anti-seize compound; the minimum amount must be applied to ensure no excess is exuded into the bores of pipes or components.

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### C. Install pipes and fittings

After installing any part of the oxygen system, effect the following:-

(1) Leak test, clean and dry all connections re-made in any installation procedure; refer to para.3 for details.

(2) On satisfactory completion of test, ensure that all connections are secure and, where applicable, wire-locked.

(3) Ensure that oxygen cylinder stop valves are wire-locked in the open position.

## 3. Adjustment/Test

Equipment and materials required :

Suction unit and altimeter - TS.251R1A
Test adapter and hose (therapeutic outlets) - WKA 32342 (W. Kidde).
Flowmeter calibrated to at least 4 litres/min.
Leak testing solution - 5% Nonidet P40 to 95% distilled water

### A. Pressure and leak tests

(1) Ensure oxygen cylinders are fully charged (see Chapter 12, SERVICING - OXYGEN), and cylinder stop valves are shut.

(2) Close the master SUPPLY valve and disconnect the valve outlet pipe.

(3) Turn on the cylinder stop valves. Check that there is no leakage across the SUPPLY valve.

(4) Reconnect the SUPPLY valve outlet pipe.

(5) Disconnect the outlet pipe from the baromatic valve, and check that the SUPPLY switch of each demand regulator is in the OFF position.

(6) Turn the master SUPPLY valve on. Check that the contents indicator registers full, and that there is no leakage across the baromatic valve.

(7) Reconnect the baromatic valve outlet pipe.

(8) Ensure that passenger supply valve is shut, then disconnect outlet pipe from valve.

(9) Manually operate baromatic valve to open position. Check that there is no leakage across the passenger supply valve. Check reading on contents indicator then shut master SUPPLY valve. Check reading on contents indicator - there should be no drop. Reconnect passenger supply valve outlet pipe.

...Oxygen system - Maintenance practices continued

(10) Leave system state as in (9) for one hour. There should be no loss of pressure, indicated by drop in contents indicator reading. If loss of pressure is indicated trace leak using leak testing solution. Thoroughly dry connections after leak test.

(11) Reset baromatic valve by pushing reset knob fully inward, then allowing knob to return to the inner detent position.

B. Flow test at crew outlets

(1) Ensure oxygen cylinders are fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valves are open.

(2) Turn the master SUPPLY valve on.

(3) Plug mask hose into quick-release socket and fit mask over face.

(4) Select demand regulator oxygen SUPPLY switch to ON and flow switch to NORMAL, and check that there is no restriction to breathing and that oxygen flow is registered on the flow indicator during inhalation only.

(5) Select flow switch to 100%, and check that there is no restriction to breathing and that oxygen flow is registered during inhalation only.

(6) Select emergency switch to EMERGENCY, and to TEST MASK and check that there is no restriction to breathing and that oxygen flow is registered continuously throughout breathing cycle in each position.

(7) Select emergency switch to NORMAL, flow switch to NORMAL, and SUPPLY switch to OFF.

(8) Remove mask from face and unplug mask hose from socket.

C. Flow test at passenger drop-out units

(1) Ensure oxygen cylinders are fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valves are open.

(2) Turn the master SUPPLY valve on.

(3) Turn passenger supply valve on.

(4) Pull baromatic valve reset knob to the outer detent position and check that all drop-out mask stowages have opened and all masks are in the 'half-hang' position.

(5) Check that there is no leakage from any mask in the 'half-hang' position.

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...Oxygen system - Maintenance practices continued

(6) At each mask in turn, remove the check valve from its clip and check that the flow indicator in the valve is spinning, and that with the mask over the face there is no restriction to breathing. Using a flowmeter, check that the flow is 3.4 ± 0.2 litres/min or 3.9 ± 0.2 litres/min (Mod.251765).

(7) Reset baromatic valve by pushing reset knob fully inward, then allowing knob to return to the inner detent position. Turn the passenger supply valve off.

(8) At each drop-out unit in turn, re-fit check valves into their respective clips, fold and stow each mask.

(9) Turn the master SUPPLY valve off.

D. Flow test at therapeutic outlets

(1) Ensure oxygen cylinders are fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valves are open.

(2) Turn the master SUPPLY valve on.

(3) Connect the flowmeter to the test adapter hose and plug in adapter to each therapeutic outlet in turn and check that a flowmeter reading of 4 ± 0.3 litres/min. is obtained.

(4) Disconnect flowmeter from adapter hose.

(5) Turn the master SUPPLY valve off.

E. Test automatic operation of baromatic valve

(1) Ensure oxygen cylinders are fully charged (see Chapter 12, SERVICING - OXYGEN) and cylinder stop valves are open.

(2) Turn the master SUPPLY valve on.

(3) Turn the passenger supply valve on.

(4) Connect suction unit and altimeter to the baromatic valve test points on the oxygen panel.

(5) Slowly apply suction; check that baromatic valve operates and that all drop-out mask units operate at an indicated altitude of 12 000 ± 500 feet.

(6) Slowly release suction; when ground level altitude is indicated on test altimeter, remove suction unit and altimeter.

(7) Reset baromatic valve by pushing reset knob fully inward, then allowing knob to return to inner detent position.

(8) Turn the passenger supply valve off.

(9) Turn the master SUPPLY valve off.

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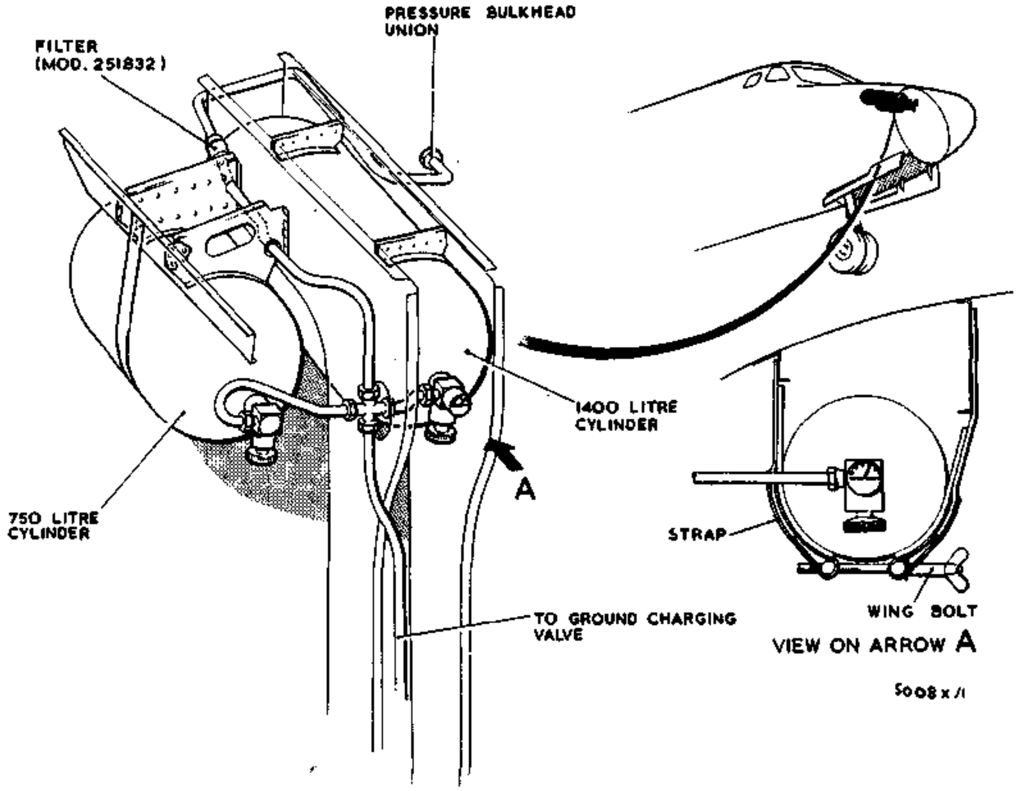
## OXYGEN CYLINDER ASSEMBLY (Mod.251630) - DESCRIPTION

The oxygen supply is contained in the oxygen cylinder assembly in the nose of the aircraft. Normally only one cylinder of 1400 litres is fitted, but, when required, an additional cylinder of 750 litres can be fitted. Both cylinders are connected to a four way union which allows both cylinders simultaneously to be charged or to feed the aircraft oxygen system. When only the 1400 litre cylinder is fitted, the appropriate coupling of the four way union is blanked off.

Each cylinder is carried in two mounting brackets lined with silicone rubber and secured with a two-piece strap lined with neoprene rubber, the strap being tightened around the cylinder by a wing bolt and trunnion assembly. The mounting brackets for the 1400 litre cylinder are on the centre line of the aircraft, those for the 750 litre cylinder are immediately to the right of the former.



Oxygen cylinder assembly
Fig.1

* * *

## OXYGEN CYLINDER ASSEMBLY (Mod.251630) - MAINTENANCE PRACTICES

WARNING : OIL OR GREASE IN CONTACT WITH UNDILUTED OXYGEN FORMS AN EXPLOSIVE MIXTURE. ALL MAINTENANCE PRACTICES MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet P40 and 95% distilled water.

A. Remove cylinder assembly

(1) Gain access to cylinder assembly by opening and securing the weather radar radome.

(2) Remove nose gear bay splash guard.

(3) Unlock the stop-valve on each cylinder and close both valves.

(4) Disconnect the pipeline at the cylinder stop-valve.

(5) Unlock the wing-bolt of the securing strap. Support the cylinder, unscrew the wing-bolt and remove cylinder.

(6) Fit blanks to pipeline and cylinder.

B. Install cylinder assembly

(1) Remove blanks from pipeline and cylinder.

(2) Locate cylinder in cradle, connect strap and tighten wing-bolt.

(3) Ensure stop-valve outlet and pipeline end and union are clean (see WARNING above).

(4) Connect pipeline to stop-valve. Open stop-valve.

(5) Leak test connection and stop-valve gland using leak testing solution. On completion of test clean off solution with distilled water, then thoroughly dry.

(6) Open stop-valve of other cylinder. Wire-lock union, stop-valves in 'open' position, and wing-bolt.

(7) Fit nose gear bay splash guard.

(8) Check oxygen system contents; charge system if necessary (see Chapter 12, SERVICING-OXYGEN).

(9) Close and secure weather radar radome.

* * *

## OXYGEN CYLINDER ASSEMBLY - MAINTENANCE PRACTICES

WARNING : OIL OR GREASE IN CONTACT WITH UNDILUTED OXYGEN FORMS AN EXPLOSIVE MIXTURE. ALL MAINTENANCE PRACTICES MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

ENSURE ALL ELECTRICAL POWER IS OFF.

### 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet LE and 95% distilled water.

### A. Remove cylinder assembly

(1) Open rear equipment bay access door.

(2) Slacken hose clips on screen tubes, and remove sealing ring halves; move screen tubes clear.

(3) Close cylinder stop valves.

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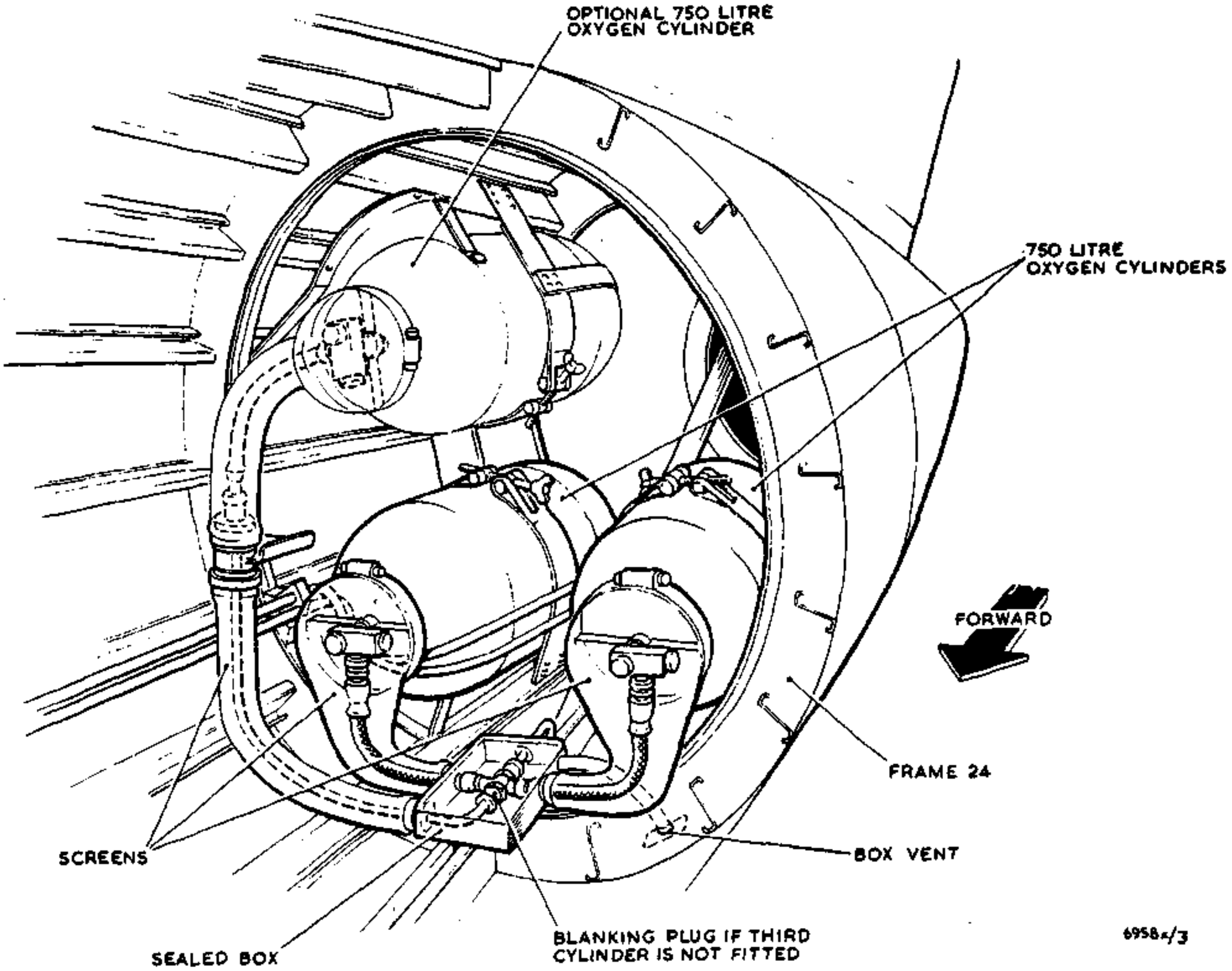
OPTIONAL 750 LITRE OXYGEN CYLINDER
750 LITRE OXYGEN CYLINDERS
FORWARD
FRAME 24
BOX VENT
SCREENS
SEALED BOX
BLANKING PLUG IF THIRD CYLINDER IS NOT FITTED
6958A/3

Oxygen cylinder assembly
Fig.201

# OXYGEN SYSTEM

# OXYGEN CYLINDER ASSEMBLY MAINTENANCE PRACTICES

**TEMPORARY REVISION 35-1**

**Reason For Issue:**

Paragraph 1.B. (3) revised to change minimum clearance between upper (3rd) oxygen cylinder and the rudder control cable. Minimum clearance between oxygen pipes and electrical equipment added.

**Action**:

In place of 35-10-14, 201 paragraph 1.B. (3) read paragraph 1.B. (3) of this TR.

## 1. REMOVAL/INSTALLATION

### B. Install cylinder assembly

(3) Loosely connect hose to cylinder and position cylinder to obtain a smooth hose run and for the upper (3rd) cylinder, to give 0.25 in. minimum clearance between cylinder and rudder control cable and 1.0 in. minimum clearance between oxygen pipes and electrical equipment. Fully tighten wing-bolt and hose connection.

...Oxygen cylinder assembly - Maintenance practices continued

(4) Disconnect hose at cylinder, allowing residual pressure to exhaust.

(5) Unscrew wing-bolt, slacken straps and remove cylinder.

(6) Fit blanks to hose and cylinder.

B. Install cylinder assembly

(1) Locate cylinder in straps, and partially tighten wing-bolt.

(2) Remove blanks from hose and cylinder.

(3) Loosely connect hose to cylinder and position cylinder to obtain a smooth hose run and for the upper (3rd) cylinder, to give 0.5 in. minimum clearance between cylinder and rudder control cable. Fully tighten wing-bolt and hose connection.

(4) Open stop valves. If necessary, replenish system (see Chapter 12, SERVICING-OXYGEN).

(5) Leak test the hose connection and stop valve gland using leak testing solution. On completion of test, clean off solution with distilled water, then thoroughly dry.

(6) Wire-lock hose connection, the wing-bolt to the strap, and the stop valves in the open position. Ensure that a split pin is fitted in the end of the wing-bolt.

(7) Position screen tubes and sealing ring halves; tighten hose clips.

(8) Check oxygen system contents, and replenish if necessary (see Chapter 12, SERVICING - OXYGEN).

(9) Close and secure rear equipment bay access door.

* * *

## CONTENTS INDICATOR - MAINTENANCE PRACTICES

### 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet P40 and 95% distilled water.

WARNING : OIL OR GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### A. Remove indicator

(1) Close SUPPLY master valve.

(2) Remove pilot's left-hand console side panel.

(3) Slowly disconnect pipeline at indicator, allowing residual pressure to exhaust to atmosphere.

(4) Remove nuts and bolts securing indicator. Remove indicator.

(5) Fit blanks to disconnected pipeline and to indicator connector.

### B. Install indicator

(1) Ensure indicator and pipeline connectors are clean and free from oil or grease.

(2) Secure indicator to panel with bolts and stiffnuts.

(3) Remove blanks and connect pipeline to indicator.

(4) Open SUPPLY master valve and leak test pipeline connection using leak testing solution. Clean off solution with clean distilled water and thoroughly dry connection after leak test.

(5) Wire-lock pipeline connection.

(6) Compare indicator reading with that shown on charging indicator.

(7) Close SUPPLY master valve.

(8) Fit and secure console side panel.

* * *

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## CONTENTS INDICATOR - MAINTENANCE PRACTICES

### 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet P40 and 95% distilled water.

WARNING : OIL OR GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### A. Remove indicator

(1) Open rear equipment bay access door.

(2) Remove screen tubes and close cylinder stop valves.

(3) Open access panel on left side of rear fuselage.

(4) Disconnect charging valve/gauge manifold pipe at filter, allowing residual pressure to escape. Remove bolts securing mounting plate, and remove mounting plate complete with charging valve and contents indicator.

(5) Disconnect pipe connection to indicator. Remove bolts securing indicator. Remove indicator.

(6) Fit blanks to the disconnected pipeline, indicator connector and filter.

### B. Installation

(1) Ensure that the indicator and pipeline connectors are clean and free from oil and grease.

(2) Remove blanks, position indicator, loosely connect pipeline and secure indicator to mounting plate with bolts. Tighten pipe connection and wire-lock. Fit mounting plate to aircraft and connect pipeline to filter.

(3) Open cylinder stop valves and leak test pipe connection using leak testing solution. Clean off solution with distilled water and thoroughly dry connection after leak test.

(4) Wire-lock pipe connection, and wire-lock cylinder stop valves in open position.

(5) Compare indicator reading with flight compartment indicator reading; replenish system if necessary (see Chapter 12, SERVICING - OXYGEN).

(6) Close and secure access panel.

(7) Fit screens tubes to cylinders and tighten hose clips. Close and secure rear equipment bay access door.

* * *

# MASTER SUPPLY VALVE - MAINTENANCE PRACTICES

## 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet P40 and 95% distilled water.

WARNING : OIL AND GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### A. Remove valve

(1) Open nose cone and close cylinder stop valve.

(2) Remove pilot's seat (see Chapter 25, CREW SEATS).

(3) Remove left-hand pilot's side console side panel.

(4) Remove valve :-

(a) Remove retaining nut (and shakeproof washer - Mod.252239) at handwheel and remove handwheel.
(b) Disconnect the short pipe at the supply (inboard) side of the valve.
(c) Disconnect the valve outlet pipe at the tee piece.
(d) Remove the screws securing the valve mounting bracket and remove bracket complete with valve and outlet pipe.
(e) Remove the outlet pipe from the valve.
(f) Remove the valve from the mounting bracket. Mod.252239, retain packing plate.

(5) Fit blanks to disconnected pipelines and valve connections.

### B. Install valve

(1) If a new valve is to be fitted, remove handwheel.

(2) Remove blanks and ensure valve and pipeline connections are clean and free from oil or grease.

(3) Pre Mod.251878, determine the direction of flow by reference to the arrow on the valve body. Mod.252239, position packing plate between valve and mounting bracket. Secure the valve to the mounting bracket with bolts and stiffnuts; post Mod.251878 the two bolts differ in size. Loosely connect the outlet pipe, removed in operation A.(4) to the valve outlet connection.

(4) Offer up the valve and mounting bracket, with outlet pipe outboard, and secure with screws.

...Master supply valve - Maintenance practices continued

(5) Position handwheel on the spindle and secure with shakeproof washer (Mod.252239)and retaining nut. Pre Mod.252239, lock nut to spindle using centre punch at two opposite positions,

(6) Connect valve outlet pipe to the tee piece and tighten both end unions.

(7) Connect and tighten the supply pipe to the inlet connection on the valve.

(8) Close master supply valve and open cylinder stop valve. Leak test inlet and outlet connections. Open master supply valve and leak test outlet connections including connections at tee piece using leak testing solution. Clean and dry all connections after testing.

(9) Wire-lock all pipe connections and wire-lock cylinder stop valve in open position.

(10) Carry out flow test at self-sealing outlet (see Chapter 35, OXYGEN SYSTEM).

(11) Install pilot's side console panel and pilot's seat (see Chapter 25, CREW SEATS).

(12) Close and secure nose cone.

* * *

## MASTER SUPPLY VALVE - MAINTENANCE PRACTICES

### 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet P40 and 95% distilled water.

WARNING : OIL AND GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

#### A. Remove valve

(1) Open rear equipment bay access door, remove screen tubes and close cylinder stop valves.

(2) Remove pilot's seat (see Chapter 25, CREW SEATS).

(3) Remove left-hand pilot's side console side panel.

(4) Remove valve :-

(a) Remove retaining nut and shakeproof washer at handwheel, and remove handwheel.
(b) Disconnect the short pipe at the supply (inboard) side of the valve.
(c) Disconnect the valve outlet pipe at the tee piece.
(d) Remove the screws securing the valve mounting bracket and remove bracket complete with valve and outlet pipe.
(e) Remove the outlet pipe from the valve.
(f) Remove the valve from the mounting bracket; retain packing plate.

(5) Fit blanks to disconnected pipelines and valve connections.

#### B. Install valve

(1) If a new valve is to be fitted, remove handwheel.

(2) Remove blanks and ensure valve and pipeline connections are clean and free from oil or grease.

(3) Position packing plate between valve and mounting bracket. Secure the valve to the mounting bracket with bolts and stiffnuts; the two bolts differ in size. Loosely connect the outlet pipe, removed in operation A. (4) to the valve outlet connection.

(4) Offer up the valve and mounting bracket, with outlet pipe outboard, and secure with screws.

(5) Position handwheel on the spindle and secure with shakeproof washer and retaining nut.

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...Master supply valve - Maintenance practices continued

(6) Connect valve outlet pipe to the tee piece and tighten both end unions.

(7) Connect and tighten the supply pipe to the inlet connection on the valve.

(8) Close master supply valve and open cylinder stop valves using leak test solution, leak test inlet and outlet connections. Open master supply valve and leak test outlet connections, including connections at tee-piece. Clean and thoroughly dry all connections after testing.

(9) Wire-lock all pipe connections and wire-lock cylinder stop valves in open position. Fit screen tubes to cylinders and tighten hose clips.

(10) Carry out flow test at therapeutic outlet (see Chapter 35, OXYGEN SYSTEM).

(11) Install pilot's side console panel and pilot's seat (see Chapter 25, CREW SEATS).

(12) Close and secure rear equipment bay access door.

(13) Replenish system if necessary (see Chapter 12, SERVICING - OXYGEN).

* * *

## DEMAND REGULATOR - MAINTENANCE PRACTICES

### 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet P40 and 95% distilled water.

WARNING : OIL OR GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### A. Remove regulator

(1) Close SUPPLY valve on left-hand console.

(2) On panel DA/E, trip circuit breaker ROOF PANEL PE BUS (grid ref.B11). (see Chapter 24, GENERAL).

(3) Remove or open access panel to regulator connections.

(4) Slowly disconnect the pipeline to the regulator, allowing residual pressure to exhaust to atmosphere.

(5) Disconnect electrical leads from adjacent terminal block.

(6) If applicable, remove regulator guard.

(7) Release the four fasteners securing regulator, withdraw regulator and slacken hose clip.

(8) Remove regulator.

(9) Fit blanking caps to inlet pipe, outlet hose and regulator connections.

### B. Install regulator

(1) If a new regulator is to be installed, transfer the inlet adapter to the new regulator, and fit the outlet connection in the same relative position. On ARO regulators, paint out the contents indicator with matching grey paint.

(2) Remove blanking caps, and connect outlet hose to regulator and tighten hose clip.

(3) Connect electrical leads to terminal block.

(4) Secure regulator to mounting with four fasteners.

(5) Connect inlet pipe to regulator and tighten union.

(6) Ensure that oxygen system is fully charged (see Chapter 12, OXYGEN).

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...Demand regulator - Maintenance practices continued

(7) Open SUPPLY valve, and leak test inlet connection using leak testing solution. Remove all traces of solution with clean distilled water and thoroughly dry connection after test.

(8) Functionally test regulator (see Chapter 35, OXYGEN SYSTEM).

(9) Reset circuit breaker, operate ROOF panel dimmer switch, and check regulator lamps for correct functioning.

(10) If applicable, fit regulator guard.

(11) Wire-lock inlet pipe connection, and, if applicable, wire-lock cylinder stop valve in open position.

(12) Secure access panel.

* * *

## QUICK-RELEASE SOCKET - MAINTENANCE PRACTICES

### 1. Removal/Installation

WARNING : OIL OR GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

A. Remove socket

(1) Position SUPPLY switch to OXYGEN REGULATOR to OFF.

(2) Remove bolts securing socket to mounting plate.

(3) Withdraw socket from mounting plate sufficiently to allow access to hose clip.

(4) Slacken hose clip and remove socket.

B. Install socket

(1) Fit hose to socket and tighten hose clip.

(2) Fit socket to mounting plate and secure with bolts.

(3) Test flow at crew outlet (see Chapter 35, OXYGEN SYSTEM).

* * *

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## AUTOMATIC SHUT-OFF VALVE - DESCRIPTION AND OPERATION

### 1. Description (Fig.1)

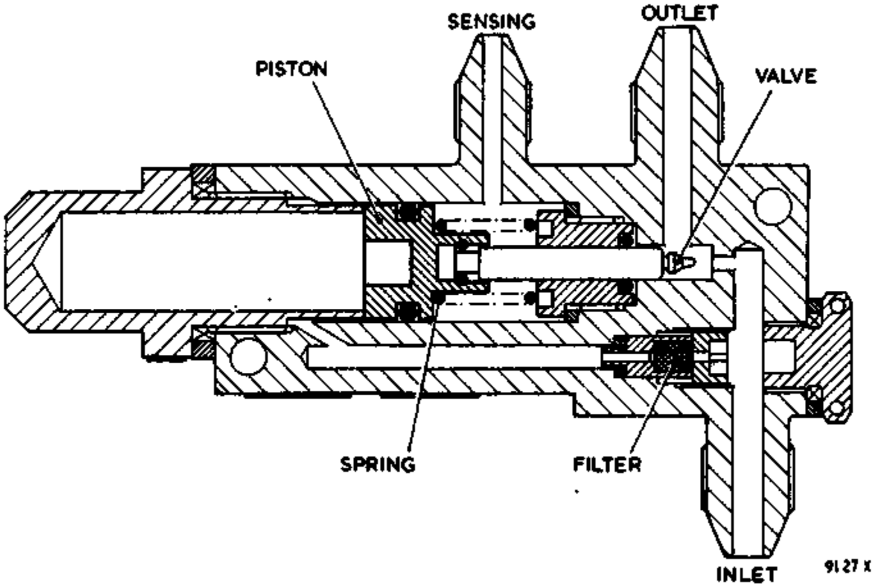
The valve is fitted to automatically shut off the oxygen supply if the supply pipeline is ruptured in the engine debris area.

The valve comprises a body with three connections; inlet, outlet and sensing. The body contains a piston and valve, with a spring to maintain the valve in the open position. An internal drilling connects the inlet port through a filter to the back of the piston.

### 2. Operation

A.Normal
Oxygen at cylinder pressure flows in the inlet connection past the open valve and out of the outlet connection. Inlet pressure is applied to one side of the piston and supply pressure to the other side of the piston, as sensed by a sensing pipeline connected to the supply pipeline forward of the engine debris area.

B.Emergency
If the supply pipeline is ruptured in the engine debris area, the pressure in the sensing pipeline drops, and when the pressure differential is 140 p.s.i.g. the piston will move to close the valve and prevent further flow to the outlet connection.



Automatic shut-off valve
Fig.1

* * *

# AUTOMATIC SHUT-OFF VALVE - MAINTENANCE PRACTICES

WARNING: OIL OR GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. FOLLOWING ACTIVITIES MUST BE EFFECTED WITH DEGREASED TOOLS AND CLEAN HANDS.

## 1. Removal/Installation

### A. Remove valve

(1) Obtain access to oxygen cylinder(s).

(2) Remove screen tubes and close cylinder stop valves.

(3) Obtain access to shut-off valve.

(4) Disconnect pipelines to shut-off valve.

(5) Remove two bolts and washers securing valve.

(6) Remove valve.

(7) Fit blanks to disconnected pipelines and valve.

### B. Install valve

(1) Examine valve for cleanliness, corrosion and damage.

(2) Remove blanks, position valve and loosely connect pipelines.

(3) Secure valve with bolts and washers. Tighten pipe connections.

(4) Open cylinder stop valve(s). Effect 'Functional Test'.

## 2. Adjustment/Test

### A. Function test of valve

(1) Open master SUPPLY valve on flight compartment oxygen panel and note gauge reading. Replenish system if necessary (see Chapter 12, SERVICING).

(2) Obtain access to oxygen cylinder(s).

(3) With screen tube(s) removed, isolate supply by closing cylinder stop valve(s).

(4) Obtain access to automatic shut-off valve.

(5) Disconnect sensing (1/8 in. B.S.P.) union at valve and, when flow ceases, blank pipe.

...Automatic shut-off valve - Maintenance practices continued

(6) Open cylinder stop valve(s) and check, using flight compartment gauge (and if necessary oxygen mask) that supply terminates.

(7) Close cylinder stop valve(s), remove blank from sensing pipe and connect pipe to shut-off valve.

(8) Slacken shut-off valve INLET pipe union and when flow ceases retighten.

(9) Open cylinder stop valve(s) and check, using flight compartment gauge, that supply is normal.

(10) Test pipe connections for leaks, using a solution of 5% Nonidet LE to 95% distilled water. Clean off solution with distilled water, and thoroughly dry connections.

(11) Wire-lock pipe connections.

(12) Wire-lock cylinder stop valves in open position.

(13) Fit screen tubes and tighten hose clips.

(14) Complete flow test at crew outlets (see Chapter 35, OXYGEN SYSTEM) and replenish oxygen system if necessary (see Chapter 12, SERVICING-OXYGEN).

(15) Close up.

* * *

# THERAPEUTIC OUTLET - MAINTENANCE PRACTICES

## 1. Removal/Installation

Materials required :
Leak testing solution - 5% Nonidet P40 and 95% distilled water.

WARNING : OIL AND GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### A. Remove outlet adapter

NOTE : † Denotes items attached by Velcro strip.

(1) Close SUPPLY master valve.

(2) Release the passenger compartment roof centre trim on one side.

(3) Remove the standby lamp cover. †

(4) Remove the access panel just aft (or forward) of the outlet adapter. †

(5) Slowly disconnect the pipeline at the outlet, allowing residual pressure to exhaust to atmosphere.

(6) Remove outlet from bracket.

(7) Fit blanks to pipeline and outlet connectors.

### B. Install outlet adapter

(1) Ensure pipeline and outlet connectors are free from oil or grease.

(2) Secure outlet to mounting bracket.

(3) Remove blanks and connect pipeline to outlet.

(4) Open SUPPLY master valve and leak test pipeline connection using leak testing solution. Clean off solution with distilled water and thoroughly dry after leak test.

(5) Wire-lock connection.

(6) Secure access panel, adjacent to the outlet, with Velcro strip.

(7) Secure standby lamp cover to centre roof panel with Velcro strip.

(8) Secure passenger compartment roof centre trim to soundproofing structure with retaining strips.

* * *

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## DUPLEX DROP-OUT MASK UNIT - MAINTENANCE PRACTICES

### 1. Removal/Installation

Materials required :

Leak testing solution - 5% Nonidet P40 and 95% distilled water.

WARNING : OIL OR GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### A. Remove unit

(1) Use adhesive tape to secure the lids of mask units not being removed.

(2) Open SUPPLY master valve.

(3) Pull PASSENGER SUPPLY EMERGENCY control knob.

(4) Check that relevant mask unit is open.

(5) Close SUPPLY master valve and push PASSENGER SUPPLY EMERGENCY control knob to isolate drop-out mask units.

(6) From inside the mask unit, remove the bolts securing the unit to the mounting brackets.

(7) Withdraw the mask unit from the roof, disengaging the hose bayonet connection at the T-piece.

(8) Fit blanks to T-piece and hose connection.

### B. Install unit

(1) Ensure hose connection and T-piece connection are clean and free from oil or grease.

(2) Remove blanks from T-piece and hose connection.

(3) Offer mask unit up to the roof and engage the hose bayonet connection with the T-piece.

(4) Open SUPPLY master valve.

(5) Pull PASSENGER SUPPLY EMERGENCY control knob.

(6) Ensure that check valves of drop-out mask unit are inserted in their clips.

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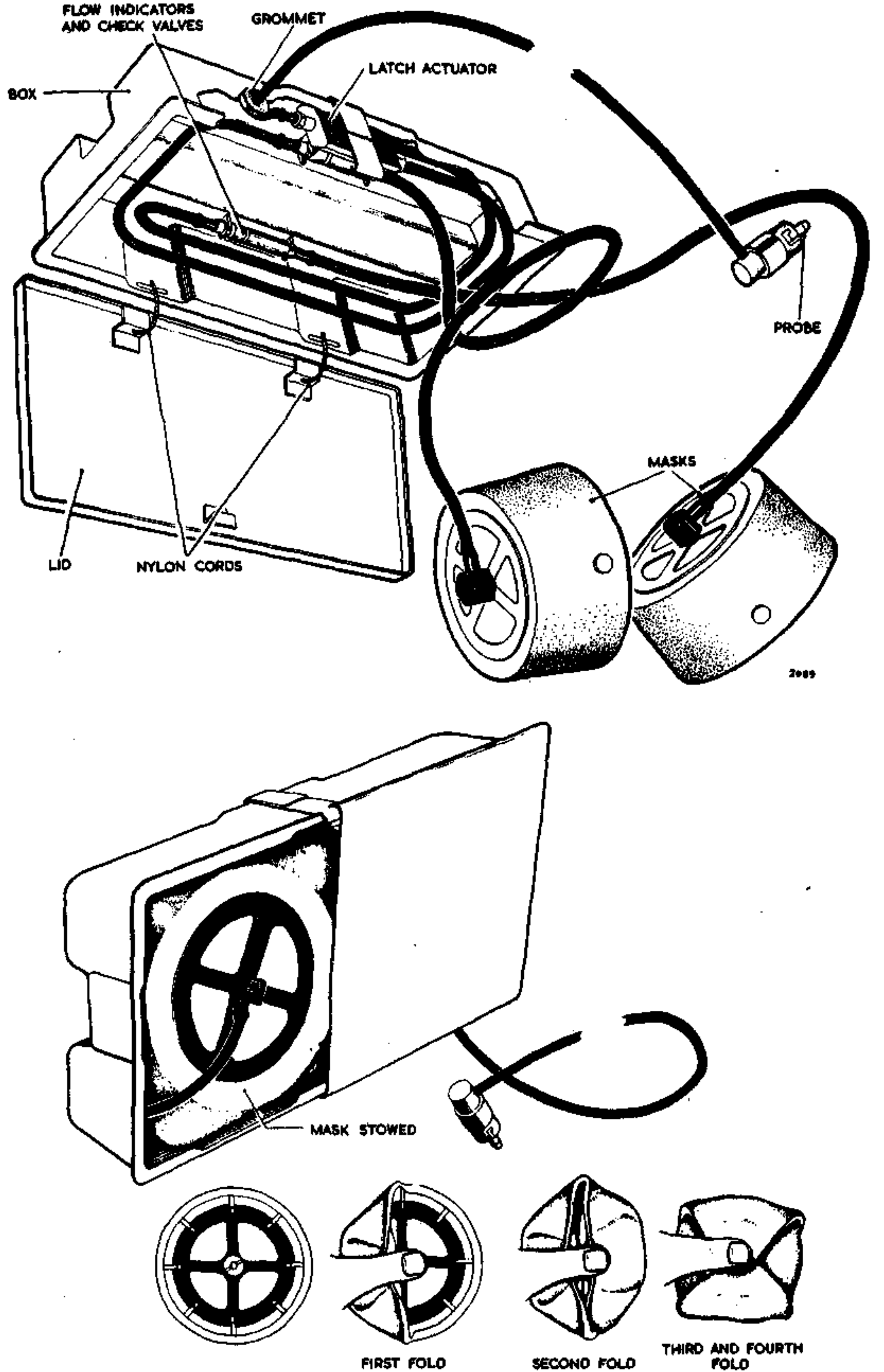

Duplex drop-out mask unit
Fig.201

...Duplex drop-out mask unit - Maintenance practices continued

(7) Leak test hose to T-piece connection using leak testing solution. Clean off solution with clean distilled water and thoroughly dry after leak test.

(8) Push PASSENGER SUPPLY EMERGENCY control knob to isolate drop-out mask units.

(9) Locate the mask unit on the mounting brackets and secure with bolts from inside the mask unit.

(10) Stow masks in box and close lid (Fig.201).

(11) Flow test unit (see Chapter 35, OXYGEN SYSTEM).

(12) Remove tape from other mask unit lids.

## 2. Cleaning/Painting

Materials required :

Cleaning solution - 1 oz. Nonidet 32G to 1 gall. warm water.

### A. Cleaning

After use, the masks should be cleaned as follows :-

(1) Using cleaning solution, wash both the inside and outside of the masks.

(2) Rinse the washed area with clean water and allow to dry.

* * *

# BAROMATIC VALVE - MAINTENANCE PRACTICES

## 1. Removal/Installation

WARNING : OIL OR GREASE IN CONTACT WITH OXYGEN FORM AN EXPLOSIVE MIXTURE. REMOVAL AND INSTALLATION MUST BE CARRIED OUT WITH DEGREASED TOOLS AND CLEAN HANDS.

### A. Remove valve

(1) Close SUPPLY master valve.

(2) Remove side panel from left-hand console.

(3) Remove knob from baromatic valve.

(4) Slowly disconnect pipelines to baromatic valve, allowing residual pressure to exhaust to atmosphere.

(5) Remove bolts and nuts securing baromatic valve.

(6) Remove baromatic valve.

(7) Fit blanks to disconnect pipelines and valve adapters.

### B. Install valve

(1) Ensure valve and pipeline connectors are clean and free from oil or grease.

(2) Secure valve to panel with bolts and stiffnuts.

(3) Remove blanks and connect pipelines to valve, and tighten union nuts.

(4) Secure knob to baromatic valve with shakeproof washer and socket head screw.

(5) Leak test baromatic valve connections (para.2.A.).

(6) Functionally test valve (see Chapter 35, OXYGEN SYSTEM, MAINTENANCE PRACTICES, Test automatic operation of baromatic valve).

(7) Wire-lock union nuts.

(8) Secure side panel to console.

## 2. Inspection/Check

Materials required :

Leak testing solution - 5% Nonidet P40 to 95% distilled water.

### A. Check baromatic valve connections for leaks

(1) Ensure oxygen cylinder is fully charged (see Chapter 12, SERVICING - OXYGEN).

(2) Remove left-hand side panel from pilots' console.

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...Baromatic valve - Maintenance practices continued

(3) Use adhesive tape to temporarily secure lids of duplex drop-out mask units and prevent masks dropping during leak check of connections.

(4) Open master SUPPLY valve.

(5) Using leak testing solution, leak test inlet connection located on plain face of baromatic valve. Pull out knob of baromatic valve to EMERGENCY position. Leak test outlet connection; located on recessed face of baromatic valve. Clean off all residual leak testing fluid with distilled water, and thoroughly dry connections after test.

NOTE : In the EMERGENCY position, a leakage of 4 litres per minute is permissible from the test point.

(6) Close master SUPPLY valve, and push in knob of baromatic valve.

(7) Remove adhesive tape from lids of duplex drop-out mask units.

B. Leak test baromatic valve

Special tools and equipment :

Flowmeter (calibrated to at least 4 litres/min).
Plug (to blank test point of baromatic valve).
Probe (to fit test point of baromatic valve).

(1) Close master SUPPLY valve.

(2) Disconnect pipeline from outlet adapter of baromatic valve; blank off outlet adapter and open end of pipeline. Outlet adapter is located in recess face of valve.

(3) Use a well fitting plug to blank one TEST point of baromatic valve.

(4) Use a well fitting probe to connect flowmeter to remaining TEST point of baromatic valve.

(5) Ensure that oxygen cylinder is fully charged (see Chapter 12, SERVICING-OXYGEN).

(6) Open master SUPPLY valve.

(7) Pull out knob of baromatic valve to emergency position.

(8) Check flow registered by flowmeter : maximum permissible flow is 4 litres/min. If the permissible flow is exceeded, remove the valve from the air- and fit a serviceable valve.

NOTE : If it is required to leak test baromatic valve when it is disconnected from aircraft oxygen system, apply a pressure of 70 lb/sq.in. at the inlet connection.

(9) If the registered flow is within limits effect operations (10) to (13).

(10) Close master SUPPLY valve and push in knob of baromatic valve.

...Baromatic valve - Maintenance practices continued

(11) Remove plug, flowmeter and probe from baromatic valve TEST points. Remove blanks from valve outlet adapter and pipeline. Connect pipeline to outlet adapter, and tighten union nut.

(12) Check outlet adapter for leaks (para.A), and wire-lock union nut.

* * *

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# CHAPTER

# 38

# WATER/
# WASTE

## LIST OF EFFECTIVE PAGES: Chapter 38 : WATER/WASTE

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* Indicates pages revised, added or deleted by the current revision.

# Chapter 38

## WATER/WASTE

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Refer to appropriate agent or equipment manufacturer
for system and component data.

38 - TOKEN PAGE

# CHAPTER

# 49

# AIRBORNE AUXILIARY POWER

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# Chapter 49

# AIRBORNE AUXILIARY POWER

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Refer to AiResearch Aviation Company Maintenance Manual, 'Auxiliary Power Unit Installation for the British Aerospace (De Havilland DH-125)' for system and component data.

# CHAPTER

# 51

# STANDARD PRACTICES-STRUCTURES

# Chapter 51

# STRUCTURES - GENERAL

## TABLE OF CONTENTS

* No separate description and operation
+ No separate maintenance practices

51-00 STRUCTURES - GENERAL

* * *

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*** Indicates pages revised, added or deleted by the current revision.**

## STRUCTURES - GENERAL

### 1. Fuselage

The fuselage is an all-metal semi-monocoque structure of stressed skin supported by frames and Redux-bonded stringers.

The area of the fuselage between the front and rear pressure bulkheads forms a pressure shell for accommodation of the crew and passengers. Framed apertures in the left and right sides of the fuselage provide for entry and emergency exits respectively.

The lower unpressurized portion of the forward nose section is built to house the nose-wheel landing gear when retracted. Forward of the front pressure bulkhead there is space provision for weather radar and associated equipment. A hinged dielectric radome is attached to the nose section forward frame.

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### 2. Wing

The main wing structure consists of a box section formed by the front, centre and rear spar, and top and bottom skins which are stiffened by Redux-bonded stringers. The left and right wing boxes are joined across the centre by spars and beams to form an integral wing unit.

Each wing box section forms an integral fuel tank. Sealants are used between faying surfaces of the spars, ribs and stringers to prevent leakage. Sealed access panels and manhole covers are provided to facilitate maintenance operations.

### 3. Tail unit

The tail unit consists of a vertical stabilizer and rudder, a horizontal stabilizer and elevator, a ventral vertical stabilizer and tail bumper, and upper vertical stabilizer.

The vertical and horizontal stabilizers are both stressed skin structures with two spars, ribs, skins and Redux-bonded stringers. The assembly is mounted on the rear fuselage with the vertical stabilizer leading edge completed by a dorsal fairing, part of which is sealed to form the dorsal fuel tank.

The upper vertical stabilizer is a composite structure of metal and glass fibre. The ventral vertical stabilizer is of glass fibre construction with honeycomb reinforcing.

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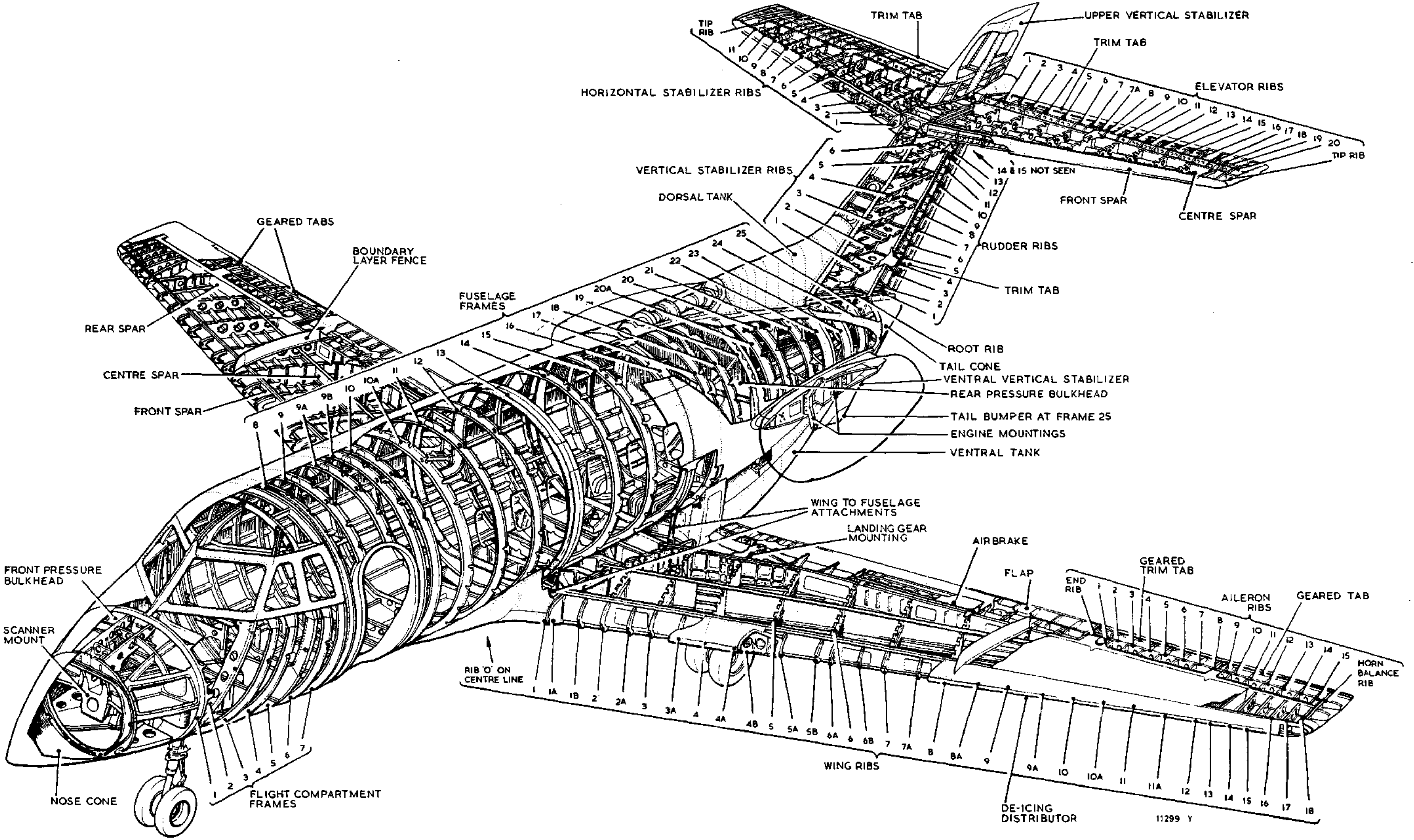
Fig.1 on following page



Aircraft structure
Fig.1

## STRUCTURES - GENERAL MAINTENANCE PRACTICES

### 1. Inspection/Check

NOTE : If any of the quoted tolerances are exceeded, inform the Product Support Department, Corporate Jets Ltd., Hatfield, Hertfordshire. England.

#### A. Check aircraft symmetry

(1) Check measurements between reference points on each side of the aircraft centre-line. See Fig.201 for tolerances and recommended reference points.

#### B. Check rigging of fixed surfaces

Special tools and equipment :-

| | |
|---|---|
| Dihedral board, wing .. .. .. | 25Y19A |
| Incidence board, horizontal stabilizer .. | 25Y195A |
| Dihedral board, horizontal stabilizer .. | 25Y587A |
| Incidence board, wing .. .. .. | 25Y829A |
| Inclinometer | |

NOTE : Each board embodies a machined and unpainted reference surface.

(1) Jack and level aircraft (see Chapters 7 and 8).

(2) Position incidence board on left wing; accurately locate the board on black painted marks. Use an inclinometer to check that the reference surface on the incidence board is 0 degrees ± 15 minutes. Record the reading obtained.

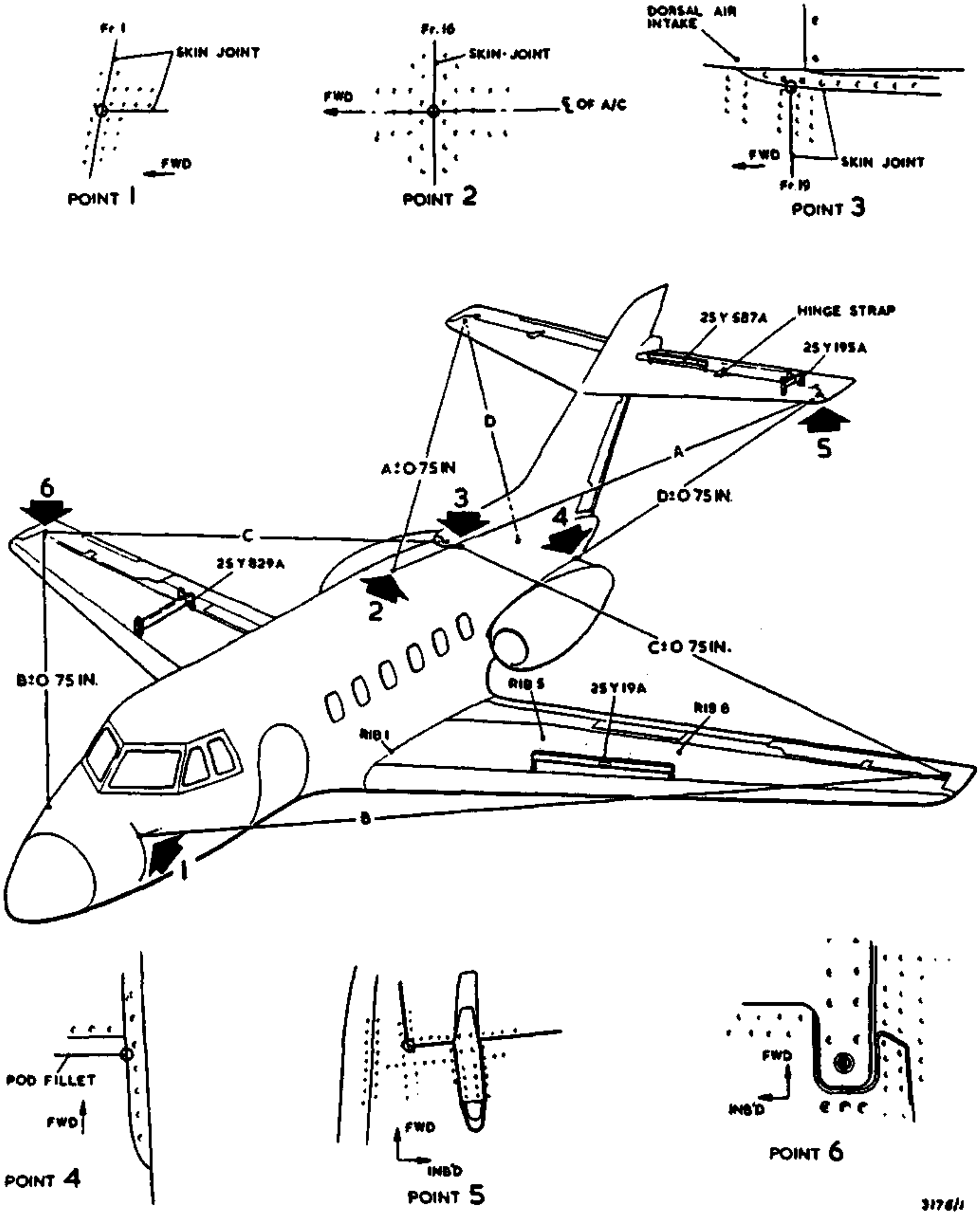
(3) Repeat operation (2) for the right wing.

(4) Position dihedral board on left wing; locate spherical feet on skin joint at front spar, between ribs 5 and 8. Use an inclinometer to check that the reference surface on the dihedral board is 0 degrees ±10 minutes. Record the reading obtained.

(5) Repeat operation (4) for the right wing.

(6) Position incidence board on left side of horizontal stabilizer; accurately locate the board on black painted marks, inboard of outer hinge. Use an inclinometer to check that the reference surface on the incidence board is within 0 degrees ± 15 minutes of the mean of the readings obtained in operations (2) and (3).

NOTE: Make sure inclinometer is positioned correctly on the reference surface of the incidence board before checking readings (Fig.202).



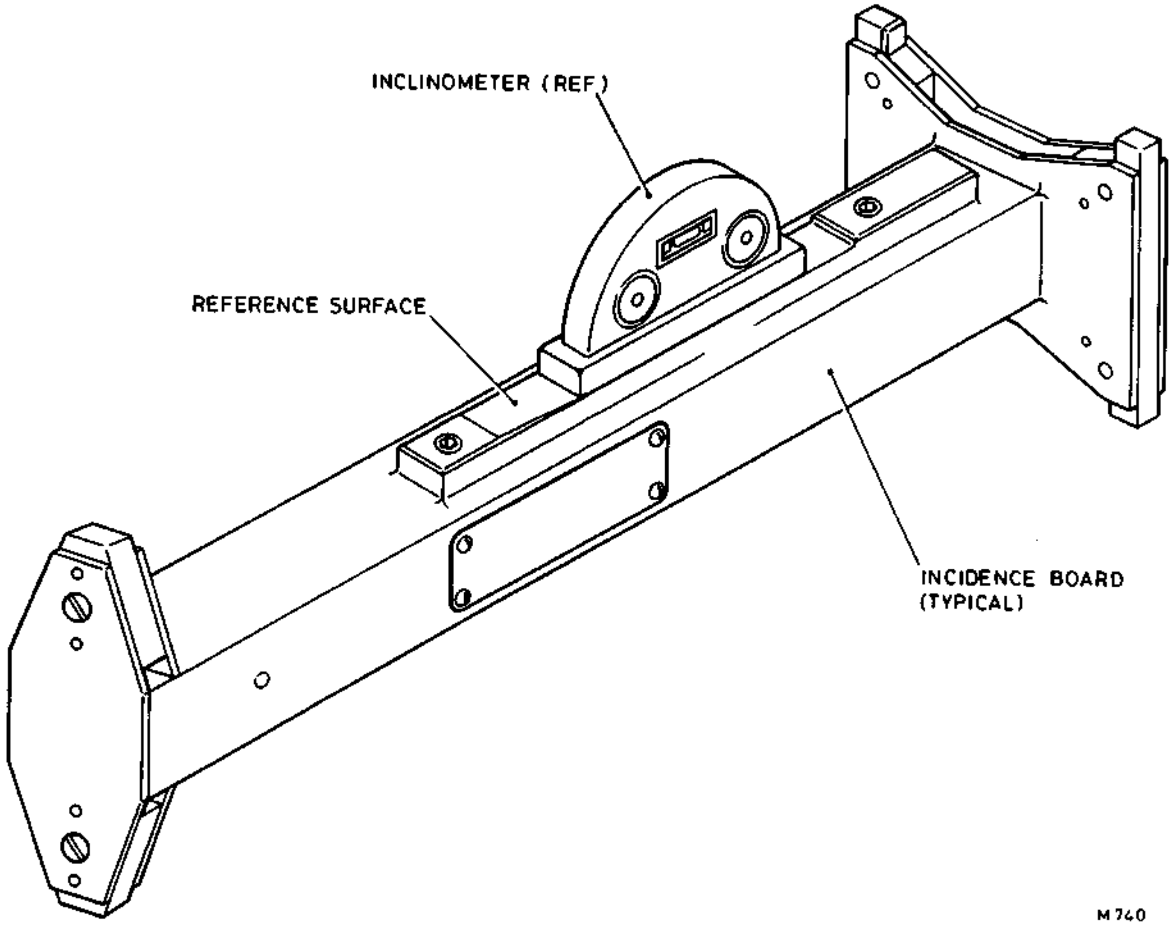
Airframe symmetry
Fig.201

(7) Repeat operation (6) for the right side of the horizontal stabilizer.

(8) Position dihedral board on left side of horizontal stabilizer, according to instructions labelled on board. Use an inclinometer to check that the reference surface on the dihedral board is within 0 degrees ± 10 minutes of the mean of the readings obtained in operations (4) and (5).

(9) Remove all boards from aircraft.

(10) Lower aircraft (see Chapter 7).



Position of inclinometer on reference surface of incidence board
Fig.202

* * *

# CHAPTER

# 52

# DOORS

## Chapter 52

## DOORS

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* No separate description
+ No separate maintenance practices

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## DOORS - GENERAL

### 1. General

An entry door and an escape hatch are provided; the entry door is located on the left side forward of the wing, and the escape hatch on the right side above the wing.

The entry door locking mechanism is operated by an internal and an external handle. When the door is unlocked, it opens outward and down. Steps are fitted on the inside of the door to provide entrance stairs when the door is open. Movement of the door is balanced by a Tensator motor fitted in the door. Cabin air leakage is prevented by a rubber seal round the door.

The escape hatch is of double skin construction and incorporates a window with its own dry air system. The hatch opens inward, and is secured at the top by a latch and at the bottom by two spherical headed bolts. The hatch is released from inside the aircraft by a handle, and from outside by a button. Cabin air leakage is prevented by a hollow rubber seal round the hatch, inflated by cabin pressure. A secondary seal is bonded to the hatch aperture to reduce noise penetration when the hatch seal is unpressurized.

Warning that the door is not shut or is unlocked is provided by a ENT DOOR UNLOCKED annunciator on the MWS panel. Power supply to the annunciator is via two microswitches; one in the door frame operated by the door bottom spigot, and the other operated by the door operating mechanism. The annunciator will light if either microswitch is not actuated.

* * *

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## ENTRY DOOR - DESCRIPTION AND OPERATION

1. Description (Fig. 1 and 2)

The entry door conforms to the profile of the fuselage on the outside, and is fitted with steps on the inside to act as entry stairs when the door is open.

The door opens outwards, pivoting on two hinge brackets fitted to the bottom edge of the door. The hinge brackets are attached to two levers on a hinge shaft, which is connected to the door operating mechanism.

The door is positioned in the door jamb by the top and bottom spigots on the door which engage with a guide and pressure plate on each door jamb. The aft pressure plate embodies the 'door closed' microswitch operating pawl. Pressurization loads on the door are taken by five latches on the front and rear of the door which engage with corresponding latches on the door jamb when the door is closed and lowered. A lock spigot and lock roller are fitted on the forward face only.

The door operating mechanism, located forward of the door between frames 7 and 8, locks and unlocks the door by raising and lowering the door hinges via the hinge shaft, and pushes the door open. The mechanism comprises an internal and external handle which are connected by rods to a cam and lever assembly. Movement of either handle is transmitted by the cam and lever assembly, via a cam follower and rod, to rotate the hinge shaft. The cam has an ineffective portion at each end to allow the anti-lift hook to be disengaged before the door is raised, and to allow the door to be pushed open after it is fully raised.

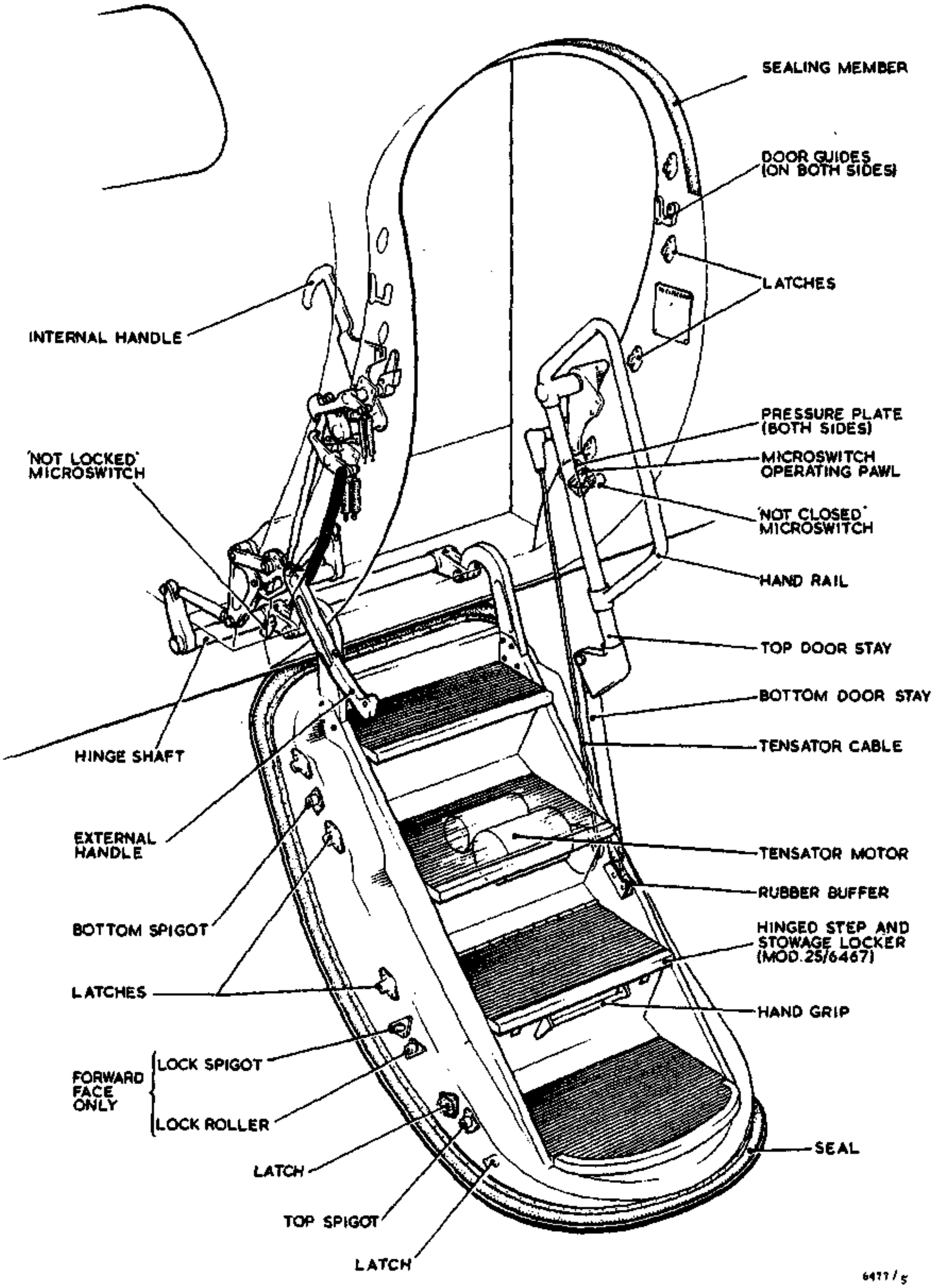
The door operating mechanism is held in the locked position by a spring-loaded detent lever, and in the unlocked position by a spring-loaded interlock plate which is on the same shaft as a striker lever, which must not be touched when the door is open.

The internal handle is located at the forward edge of the door aperture, and the external handle fits flush in the fuselage skin forward of the door. The external handle can be locked in the closed position by a key which operates an integral lock in the handle; provision for fitting a Customs seal across the external handle is made by two bolts with drilled heads fitted one fore and one aft of the handle.

The door opening is limited by a door stay with secondary stops comprising a projection on each hinge bracket which nearly contacts a shimmed stop bolt. The upper part of the door stay is extended to form a hand rail. Mod. 252078 Pt. E introduces spring-loaded joints in the door stay to improve its stability.

The raising and lowering of the door by the hinge shaft, is controlled at each hinge by a stop plate which is contacted by projections on the hinge shaft levers. The lowered position is adjustable using shims.

Fitted in the door is a Tensator motor which controls the rate of opening and assists in closing. The Tensator motor comprises four Tensator springs, which are wound on a storage drum (pre mod. 252156) or four independent storage drums (mod. 252156), a torque drum, two spur gears and a cable drum. As the door opens, the springs are wound on to the torque drum by a cable attached between the cable drum and the door jamb, thus taking the weight of the door, and assisting in closing the door as the springs unwind on to the storage drums(s).



Entry door installation
Fig.1

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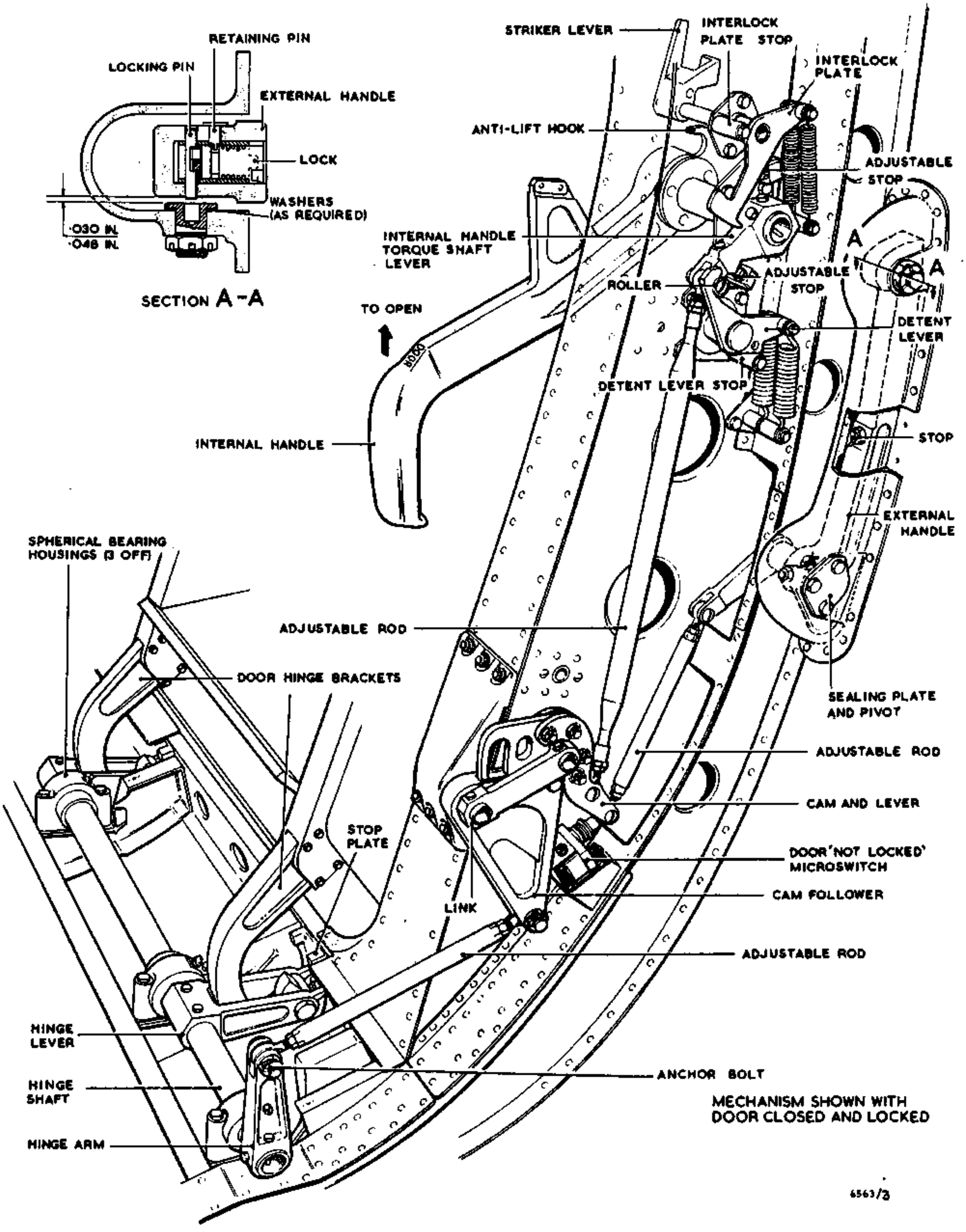


Door operating mechanism
Fig. 2

...Entry door - description and operation continued

The door is sealed to the fuselage by a hollow rubber seal fitted round the door. Holes in the door allow cabin pressure to enter the seal and force it against the door jamb. To improve the sealing and reduce the door operating loads, the door jamb is unpainted and polished where the seal contacts.

A water drain valve is fitted in the outer skin at the top and bottom of the door to drain the door in the open and closed positions.

## 2. Operation

### A. To open

The door is unlocked by pulling the internal handle up or pulling the external handle down. The initial movement (approx. 17°) frees the anti-lift hook from the lock spigot on the door and overrides the detent lever. Further movement of either handle rotates the hinge shaft and lifts the door hinges thus disengaging the latches, door guides and striker lever; the final movement (approx. 13°) of the handles causes the internal handle extension to contact the door lock roller and push the door open, and the torque shaft lever roller to engage the interlock plate. The door falls open, restrained by the Tensator motor winding up. The mechanism is prevented from moving back, to the position where the door hinges are lowered, by the interlock hook, thus avoiding damage to the door frame which could be caused if the door hinges are lowered when the door is open.

### B. To close

The door is closed by breaking the dead centre condition of the door stay joint (pre mod. 252078 Pt. E), or, (mod. 252078 Pt. E) by overcoming the spring-loading on the door stay joints, and raising the door assisted by the Tensator motor. When nearly closed, the lock roller on the door contacts the striker lever, causing the interlock hook to be depressed and allows the handles to be moved to lower the door. With the door spigots entered in the door guides, the door is lowered using either handle, the door latches engage behind the door jamb latches and the lock roller engages in the striker lever. The final movement of the handles engages the anti-lift hook with the lock spigot, in which position the handles are retained by the detent lever. Closing the door from inside the aircraft is assisted by using the extension hand rail fitted to the top door stay, and a hand grip fitted below the second step.

The geometry of the door operating mechanism makes it irreversible, but, as an additional safeguard, the engagement of the anti-lift hook prevents the door from rising in flight under negative 'g' loads.

* * *

## ENTRY DOOR - MAINTENANCE PRACTICES

**WARNING:** BE CAREFUL WHEN DISCONNECTING OR CONNECTING THE TENSATOR MOTOR CABLE. THE CABLE IS UNDER SPRING PRESSURE FROM THE TENSATOR MOTOR SPRINGS AND CAN CAUSE INJURY TO PERSONNEL. MAKE SURE THAT THE TENSION OF THE CABLE IS REDUCED TO A MINIMUM BEFORE REMOVAL OR INSTALLATION OF THE CABLE.

**CAUTION:** DAMAGE CAN BE CAUSED IF THE DOOR IS CLOSED OR PARTLY CLOSED AND THEN OPENED WHEN THE ROD BETWEEN THE CAM FOLLOWER AND HINGE ARM IS DISCONNECTED, OR IF THE INTERLOCK LEVER HAS BEEN UNLOCKED MANUALLY.

### 1. Unit Servicing

#### A. Lubrication

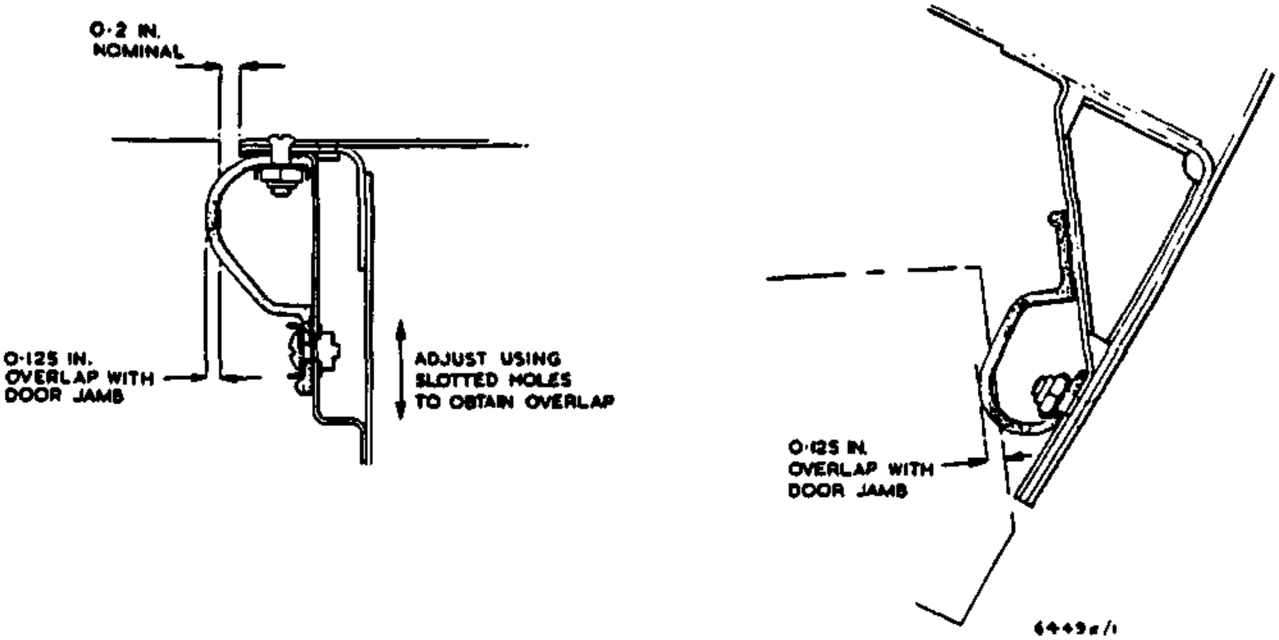
For lubrication data refer to the Maintenance Schedule.

#### B. Renew seal

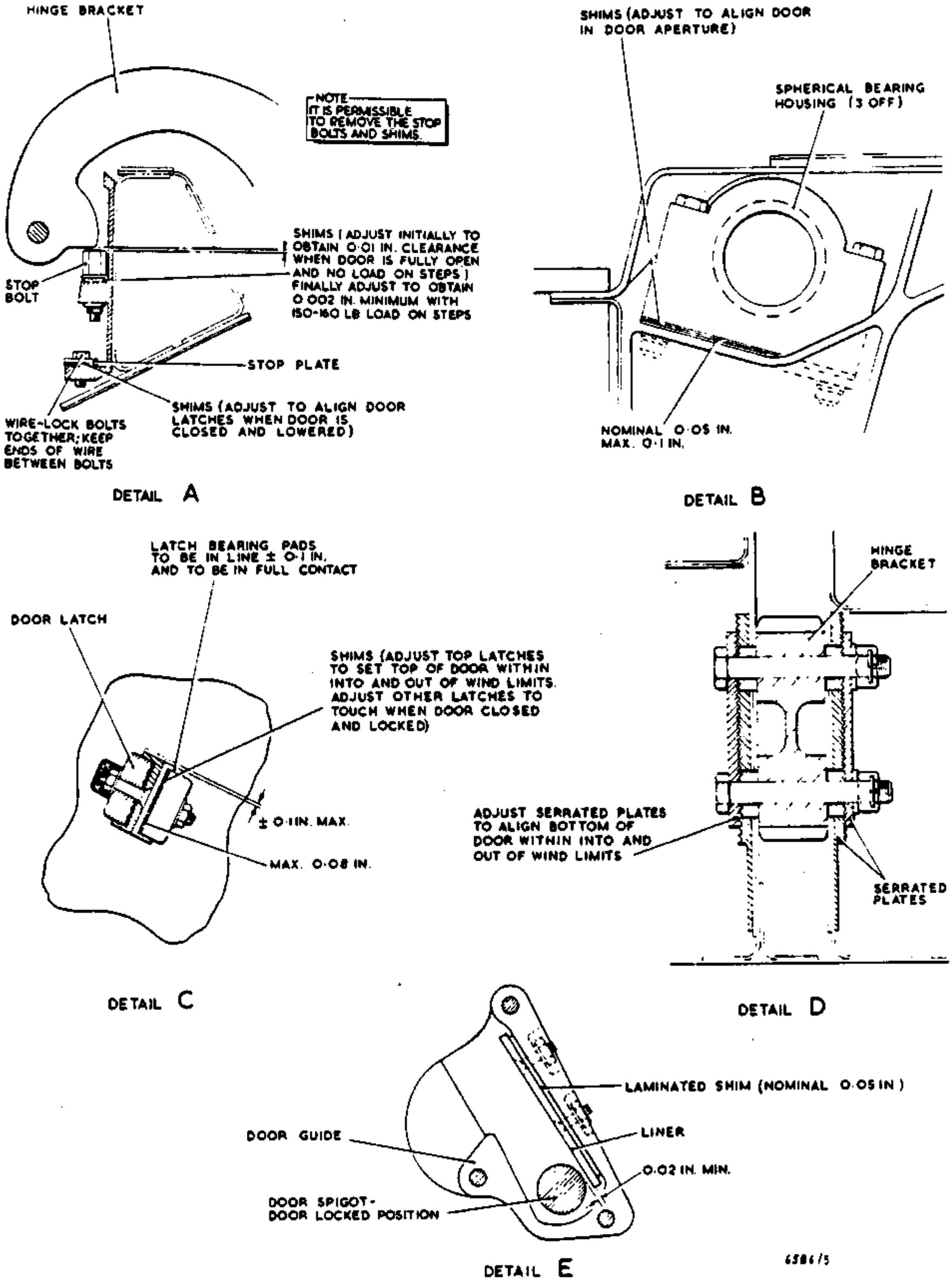
| Equipment/Materials | Item No./Source |
|---|---|
| Sealing compound | 316 (Ref. AMM 20-95-301) |

Referenced procedures:

| | |
|---|---|
| 20-10-1002 | Sealing of pressure cabins |



Typical seal sections
Fig.201


HINGE BRACKET
NOTE
IT IS PERMISSIBLE TO REMOVE THE STOP BOLTS AND SHIMS.
SHIMS (ADJUST INITIALLY TO OBTAIN 0·01 IN. CLEARANCE WHEN DOOR IS FULLY OPEN AND NO LOAD ON STEPS) FINALLY ADJUST TO OBTAIN 0·002 IN. MINIMUM WITH 150-160 LB LOAD ON STEPS
STOP BOLT
STOP PLATE
SHIMS (ADJUST TO ALIGN DOOR LATCHES WHEN DOOR IS CLOSED AND LOWERED)
WIRE-LOCK BOLTS TOGETHER; KEEP ENDS OF WIRE BETWEEN BOLTS
DETAIL A
SHIMS (ADJUST TO ALIGN DOOR IN DOOR APERTURE)
SPHERICAL BEARING HOUSING (3 OFF)
NOMINAL 0·05 IN. MAX. 0·1 IN.
DETAIL B
LATCH BEARING PADS TO BE IN LINE ± 0·1 IN. AND TO BE IN FULL CONTACT
DOOR LATCH
SHIMS (ADJUST TOP LATCHES TO SET TOP OF DOOR WITHIN INTO AND OUT OF WIND LIMITS. ADJUST OTHER LATCHES TO TOUCH WHEN DOOR CLOSED AND LOCKED)
± 0·1 IN. MAX.
MAX. 0·08 IN.
DETAIL C
HINGE BRACKET
ADJUST SERRATED PLATES TO ALIGN BOTTOM OF DOOR WITHIN INTO AND OUT OF WIND LIMITS
SERRATED PLATES
DETAIL D
LAMINATED SHIM (NOMINAL 0·05 IN)
LINER
DOOR GUIDE
0·02 IN. MIN.
DOOR SPIGOT-DOOR LOCKED POSITION
DETAIL E
6584/5

Door adjustments
Fig.202

(1) With door open, remove bolts and channels securing inner edge of seal. Identify channels as they are removed.

(2) Remove nuts and channels from inside of seal, identifying channels as they are removed. If necessary, retain bolts with adhesive tape. Remove seal from door.

(3) Remove new seal from packing and allow it to take up its natural shape. Position seal on to the bolts around door, starting at the centre on each side and working towards each end. Secure seal with channels and nuts as work proceeds. Post Mod.252078 Pt.B; fit thin nuts to the five bottom centre bolts; ensure that the bolts do not protrude more than 0.05 to 0.07 in. and overcoat nuts with sealing compound (Consumable Material No.316) (Refer to AMM 20-10-1002 for procedure).

NOTE: The seal will more readily assume its natural shape in warm conditions.

(4) Fit bolts and channels loosely to inner edge of seal. Using the slotted holes, adjust the seal to obtain 0.125 in. overlap with the door jamb and tighten the bolts.

## 2. Removal/Installation

### A. Remove door

WARNING: BE CAREFUL WHEN DISCONNECTING OR CONNECTING THE TENSATOR MOTOR CABLE. THE CABLE IS UNDER SPRING PRESSURE FROM THE TENSATOR MOTOR SPRINGS AND CAN CAUSE INJURY TO PERSONNEL. MAKE SURE THAT THE TENSION OF THE CABLE IS REDUCED TO A MINIMUM BEFORE REMOVAL OR INSTALLATION OF THE CABLE.

(1) Open door, ease back the cover on the Tensator motor cable attachment and remove the nut and washer from the cable attachment bolt.

(2) Raise the door to remove tension from cable but do not lock, remove the cable attachment bolt (Pre-Mod.252078 Pt.C) or remove eye end from bolt (Mod.252078 Pt.C). Maintaining tension in the cable, tape cable to the door structure to prevent cable winding off the cable drum.

(3) Taking the weight of the door, carefully lower to the open position.

(4) Remove floor panel from above hinges.

(5) Support door, and Pre-Mod.252078 Pt.E, remove shear pin securing door stay link to door fitting. Mod.252078 Pt.E, remove pin connecting door stay to door fitting link.

(6) Taking weight of door, remove the hinge attachment bolt split pins and nuts. Remove the attachment bolts against the resistance of the retaining circlips.

(7) Partially close door to disengage hinge brackets. Remove door.

(8) Mod.252078 Pt.E; If a new door is to be fitted, transfer door fitting link to new door (Ref.Fig.204).

B. Install door (Ref.Fig.202)

Referenced procedures:

| | |
|---|---|
| 21-30-07 | Pressurization control |
| 52-71 | Door warning |

(1) Offer up door and position hinges in shaft levers. Ensure that circlips are fitted in levers and fit bolts and nuts. Do not install split pins at this stage.

CAUTION: CAREFULLY APPLY ANY WEIGHT ON THE STEPS UNTIL THE STOP BOLTS ARE CORRECTLY ADJUSTED.

(2) Pre-Mod.252078 Pt.E; Support door and connect door stay link to door fitting with shear pin, collar and split pin. Mod.252078 Pt.E; Carry out door stay adjustment (Refer to para.3.C.). With door stay fully extended and with weight of an average person (150 - 160 lb.) on bottom step, check that there is a minimum clearance of 0.002 in. between stop bolts and hinge brackets (detail A). If necessary adjust shims so that there is a clearance of 0.01 in. with no load on steps, and finally adjust shims to obtain 0.002 in. minimum clearance with load on.

NOTE: It is permissible to remove the stop bolts, thus making the stop bolt check redundant.

WARNING: BE CAREFUL WHEN DISCONNECTING OR CONNECTING THE TENSATOR MOTOR CABLE. THE CABLE IS UNDER SPRING PRESSURE FROM THE TENSATOR MOTOR SPRINGS AND CAN CAUSE INJURY TO PERSONNEL. MAKE SURE THAT THE TENSION OF THE CABLE IS REDUCED TO A MINIMUM BEFORE REMOVAL OR INSTALLATION OF THE CABLE.

(3) Raise door and connect cable eye end bolt on door jamb with bolt, washer and nut. Pre-Mod.252078 Pt.C; insert bolt from front. Mod.252078 Pt.C; insert bolt from rear.

(4) With door closed, check that door is central and parallel with sides of door aperture. If necessary, correct alignment by adjusting the shims under the hinge shaft spherical bearing housing (detail B).

(5) With door closed and locked, check that the latches on the door and door jamb are vertically in line ± 0.1 in. and are in full contact (detail C). If necessary, adjust shims under stop plates (detail A) to achieve correct vertical position when door is lowered; adjust rod between cam follower and hinge lever so that with the door operating mechanism on the bottom stop and the door fully lowered on stop plates, a light pressure exists between the cam roller and the upper surface of the cam slot.

(6) Push door outwards and check that the top of the door is flush or not more than 0.08 in. out of wind when the latches are touching. If necessary, adjust shims under latch bearing pads on the door jamb (detail C), in conjunction with (16).

NOTE: Do not alter the shimming of latches on the door, they are jig located.

(7) Check that the remainder of the door is flush or not more than 0.08 in. out of wind. If necessary, adjust the serrated plates on the hinge bracket attachments (detail D) and re-adjust the shimming of the door jamb latches, in conjunction with operation (16).

(8) Check that there is a minimum clearance of 0.02 in. between each door top spigot and the door guide liner when the latches are in contact (detail D).

(9) Check that door closes properly; that a gap of 0.2 ± 0.05 in. exists between door and fuselage skin.

(10) Position door seal to obtain overlap (Refer to para.1.B.).

(11) Check that the Tensator motor starts to wind up when the door is opened 1.5 to 2.5 in. at the top. Adjust the cable end as necessary, tighten locknut and safety with lockwire. Fit washer, nut and split pin to attachment bolt. Position cover over cable end.

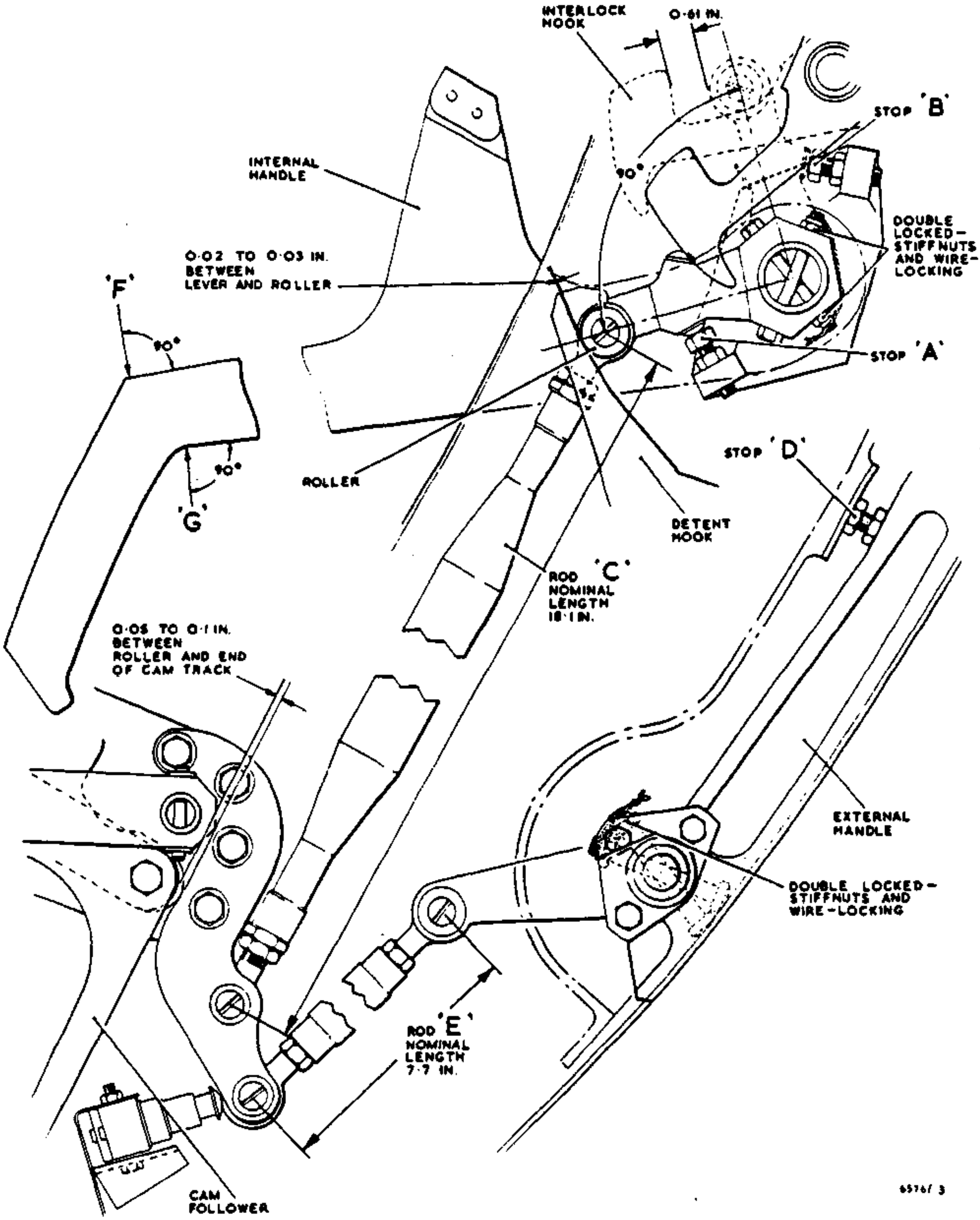
(12) Adjust cable fairlead plates on door as necessary to obtain clearance between cable and plates throughout door travel, and adjust fairlead rubber so that cable is located in slot when door is open, and runs smoothly round slit throughout door travel.

(13) Fit split pins to door hinge attachment bolts and install floor panels.

(14) Check adjustment of door 'not closed' microswitch (Ref. AMM 52-71) and check that the door warning lamp lights when the door is not closed or is unlocked.

(15) Carry out a cabin leak rate test (Ref. AMM 21-30-07).

(16) During cabin leak rate test, when the cabin differential is 4.0 psi, check that the door is not into wind more than 0.05 in. below the top latches or more than 0.1 in. above the top latches, or is not out of wind more than 0.05 in. If necessary, adjust as in operations (6) and (7)) to achieve unpressurized limits.


INTERLOCK HOOK
0·61 IN.
STOP 'B'
INTERNAL HANDLE
90°
DOUBLE LOCKED-STIFFNUTS AND WIRE-LOCKING
0·02 TO 0·03 IN. BETWEEN LEVER AND ROLLER
'F'
90°
STOP 'A'
ROLLER
STOP 'D'
90°
'G'
DETENT HOOK
ROD 'C' NOMINAL LENGTH 18·1 IN.
0·05 TO 0·1 IN. BETWEEN ROLLER AND END OF CAM TRACK
EXTERNAL HANDLE
DOUBLE LOCKED-STIFFNUTS AND WIRE-LOCKING
ROD 'E' NOMINAL LENGTH 7·7 IN.
CAM FOLLOWER
65761 3

Door operating mechanism adjustments
Fig.203

## 3.Adjustment/Test

### A.Rig door operating mechanism (with door closed) (Ref.Fig.203)

Referenced procedures:

| | |
|---|---|
| 52-71 | Door warning |

CAUTION: DO NOT OPEN THE DOOR WHEN THE ROD BETWEEN THE CAM FOLLOWER AND THE HINGE ARM IS DISCONNECTED.

(1) Disconnect rod between cam follower and hinge arm.

(2) Screw in stop 'D' on external handle. Press internal handle down on to stop 'A' and check there is a clearance of 0.02 to 0.03 in. between detent lever and roller. Adjust stop 'A' as necessary, tighten locknut and safety the stop with lockwire.

(3) With internal handle on stop 'A', check that a clearance of 0.05 to 0.1 in. exists between roller and end of cam track. Adjust rod 'C' as necessary, tighten locknut and safety eye ends to rod with lockwire.

(4) Adjust stop 'D' so that profile of external handle aligns with outside skin and tighten locknut. If necessary, adjust rod 'E' so that the external handle bears lightly on its stop when the internal handle is on stop 'A'. Tighten locknut and safety eye ends to rod with lockwire.

(5) Raise internal handle on stop 'B' and check that a clearance of 0.61 in. exists between roller and interlock hook. Adjust stop 'B' as necessary, tighten locknut and safety the stop rod with lockwire.

(6) Lower handle and check that when the detent hook has engaged on the roller, the detent lever springs pull the complete mechanism on to the stops without manual assistance.

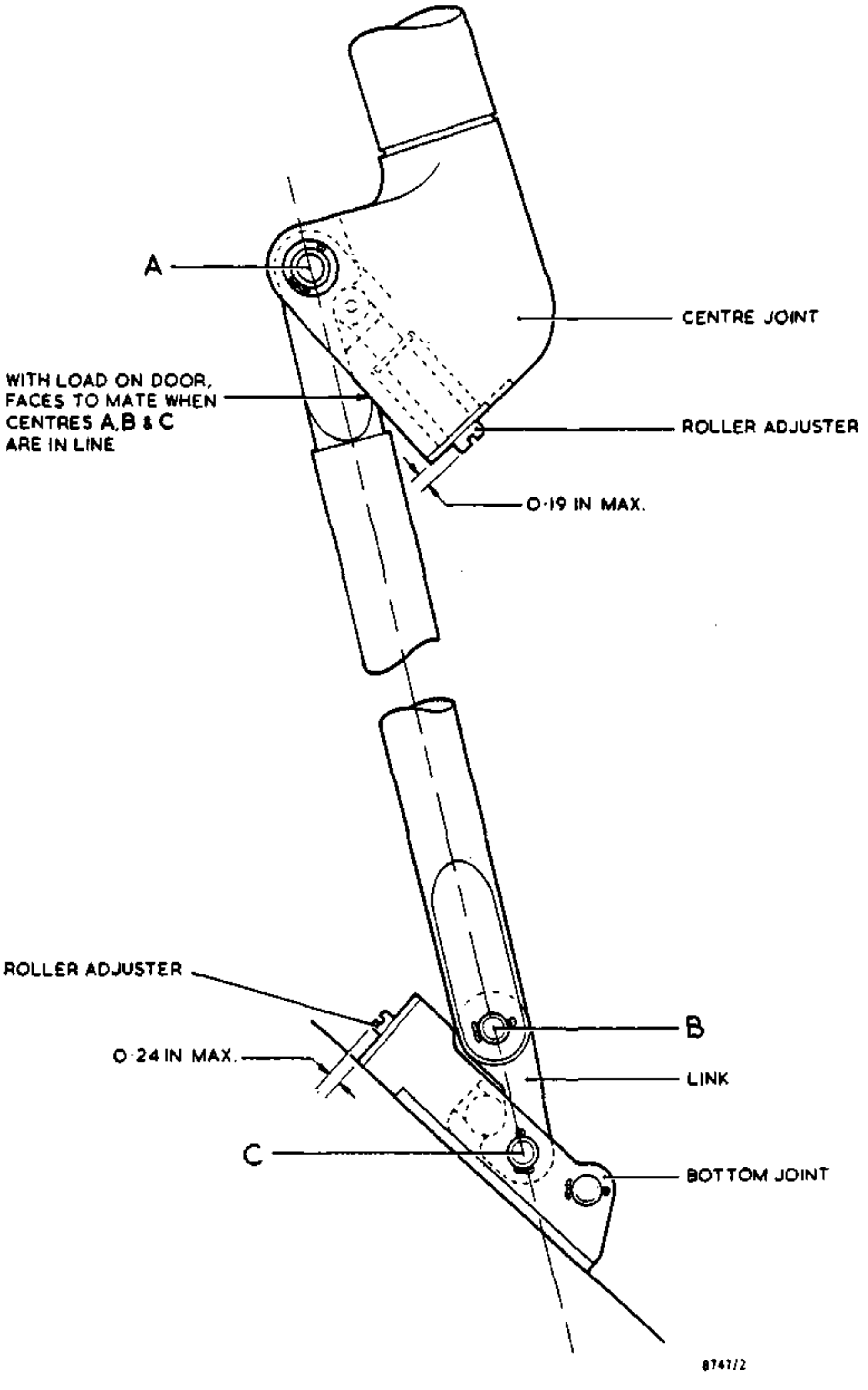
(7) Check adjustment of door 'not closed' microswitch (Ref. AMM 52-71).

(8) With the door operating mechanism in the door locked position and door closed and fully lowered, connect rod between cam follower and hinge arm, tighten nut and fit split pin. Adjust rod as necessary until light pressure exists between the cam roller and the upper surface of the cam slot, tighten locknut and safety the eye ends to rod with lockwire.

### B.Door loading tests (Ref.Fig.203)

(1) Check that the load at point 'F' to push the internal handle into the down detent position is 50 to 60 lb.

(2) Check that the load at point 'G' to pull the internal handle out of the detent position is 48 to 52 lb.



Door stay adjustment
Fig.204

(3) Check that the load to lift the door using the internal handle does not exceed 65 lb.

C. Door stay adjustment

NOTE: For adjustment in position, remove shear pin connecting bottom door stay to door fitting link.

(1) Adjust centre joint as follows:

(a) Turn roller adjuster fully in a clockwise direction.

CAUTION: DAMAGE MAY BE CAUSED IF THIS PROCEDURE IS NOT FOLLOWED.

(b) Fold the joint until the roller is on the peak of the cam (that is with adjuster at maximum protrusion). Maintain this position and carefully turn adjuster counter-clockwise until the spring is fully compressed. Then turn the adjuster one full turn clockwise.

(c) Straighten the door stay and check that the adjuster does not extend more than 0.19 in. from the retaining plate.

(d) Connect bottom stay to door fitting link, using shear pin, spacers and collar. Lock with split pin.

(2) Adjust the bottom joint as follows:

(a) Turn roller adjuster fully in a clockwise direction.

(b) Unscrew adjuster counter clockwise one turn at a time, until the following conditions are achieved:

1 The door stays have a positive locking action when opening door.

2 The bottom stays remain locked with a person stepping on and off bottom step.

3 The centre joint unlocks before the bottom joint when door is closed.

4 The door stays are rigid in the open position.

5 When the conditions of 1 to 4 are obtained, check that the bottom joint adjuster does not extend more than 0.24 in. from the retaining plate.

(3) Check that, with the door open and a load on the steps, the faces of the upper and lower stay end fittings mate when the pivots of the centre joint, link and bottom joint (A, B and C) are in line (Ref.Fig.204). If necessary, carefully dress the bottom stay end fitting.

## 4. Cleaning/Painting

The DOOR PULL engraving on the external handle must either be filled with paint to comply with local regulations or with paint to contrast with the external finish.

## 5. Approved Repairs

### A. Remove external handle and shaft to facilitate access for bush removal

(1) Open entry door.

(2) Remove bolts securing sealing handle to shaft.

(3) Remove split pin and nut from shaft.

(4) Remove bolts securing sealing plate to forward face of lever housing. Remove sealing plate.

(5) Remove reinforcing plate from frame forward of mechanism. Support lever and external handle and remove shaft through hole in frame.

### B. Install external handle and shaft

(1) Position lever and external handle and install shaft through hole in frame.

(2) Fit nut to shaft. Tighten and safety with split pin.

(3) Position sealing plate and secure with bolts.

(4) Fit bolts to secure handle to shaft. Fit and tighten stiffnuts. Wirelock the bolts together.

(5) Position reinforcing plate on frame and secure with bolts.

## TENSATOR MOTOR - MAINTENANCE PRACTICES

### 1. Removal/Installation

| Equipment/Materials | Item No./Source |
|---|---|
| Locking pin | ¼ in. dia x 6 in. |
| Winding key | Pt.No. 25Y1555 |
| Grease | 078 (Ref. AMM 20-95-11) |
| Sealing compound | 309 (Ref. AMM 20-95-301) |

### A. Remove Tensator motor

(1) With door open, remove step above motor and access panel on aft face of door.

(2) Ease back cover from cable end. Remove split pin, washer and nut from cable attachment bolt.

**WARNING:** BE CAREFUL WHEN DISCONNECTING OR CONNECTING THE TENSATOR MOTOR CABLE. THE CABLE IS UNDER SPRING PRESSURE FROM THE TENSATOR MOTOR SPRINGS AND CAN CAUSE INJURY TO PERSONNEL. MAKE SURE THAT THE TENSION OF THE CABLE IS REDUCED TO A MINIMUM BEFORE REMOVAL OR INSTALLATION OF THE CABLE.

(3) Close door but do not lock. Taking weight of door, remove cable attachment bolt (Pre-Mod.252078) or remove eye end from bolt (Mod.252078). Carefully lower door to the open position.

(4) Remove eye end, locknut and cover from cable. Pass cable end through fairlead.

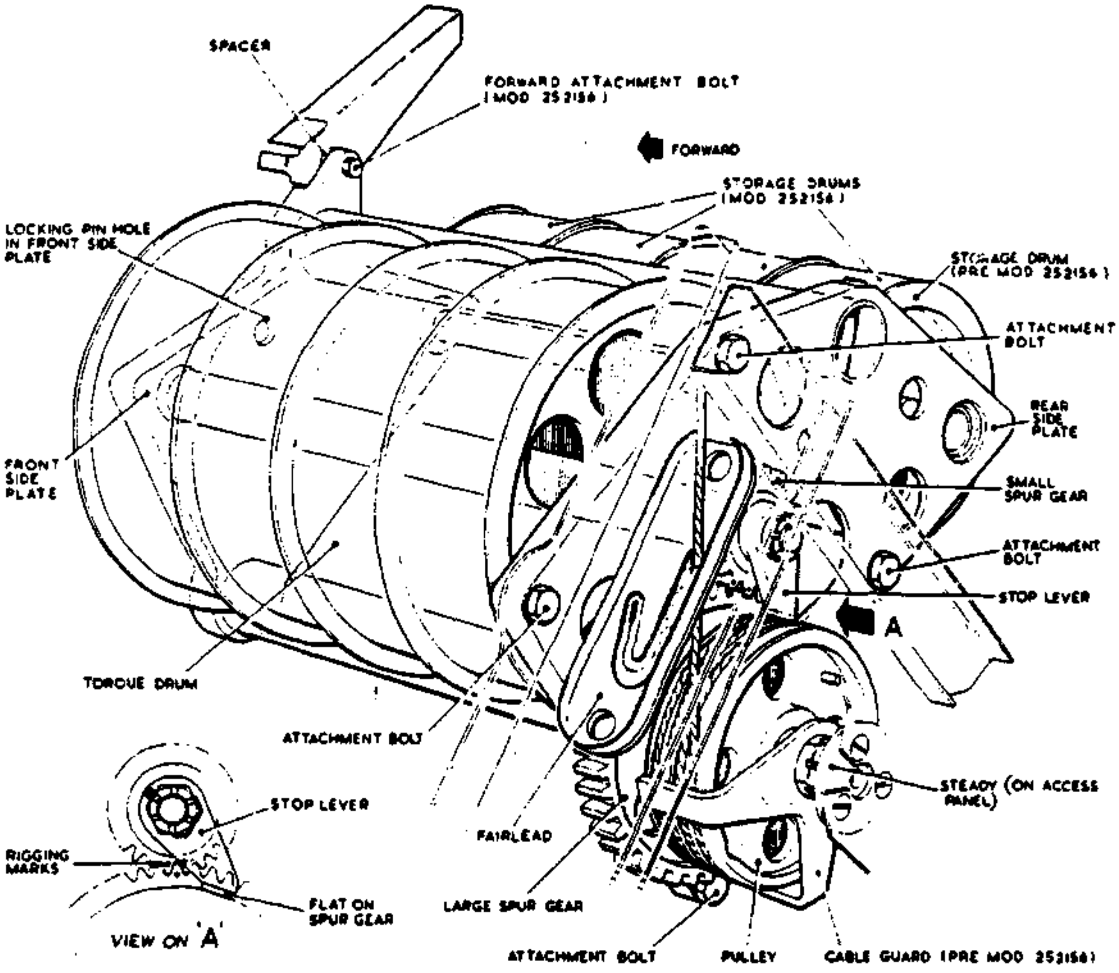
(5) Lock the torque drum by inserting a locking pin in the locking pin hole in the forward side plate and in the rigging hole in the centre plate of the torque drum; if necessary rotate the drum slightly using the winding key on the spline at the forward end of the torque drum.

(6) Remove split pin, washer and nut from small spur gear; remove stop lever, small spur gear and spacer from torque drum shaft.

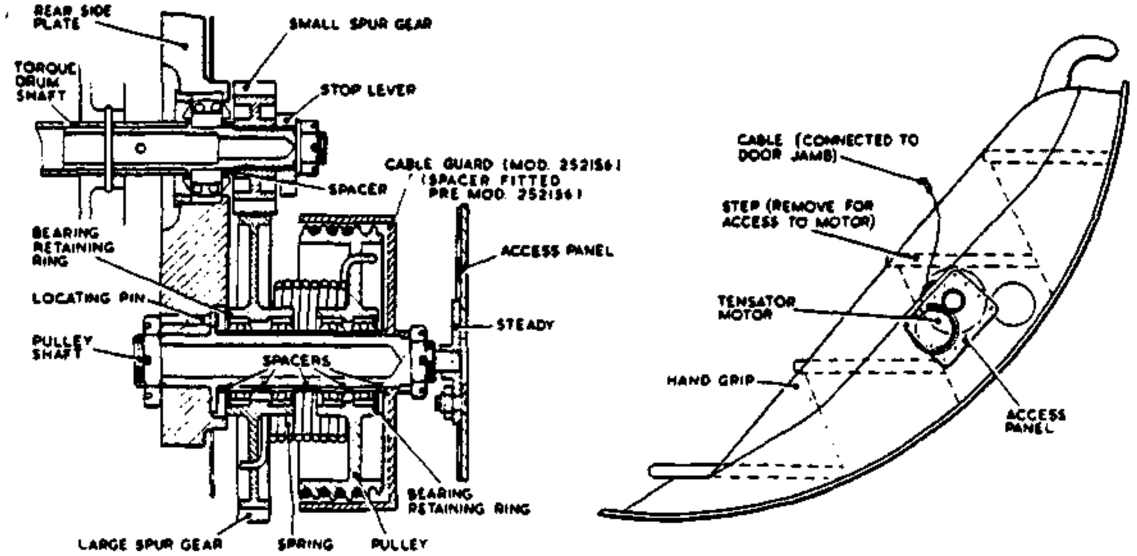
(7) Remove split pin and nut from aft end of pulley shaft.

(8) Support motor, remove the nut, bolt and spacer from the forward attachment (Mod.252156) and remove the four rear attachment bolts (assembled with sealing compound, consumable material No.309) and washers. Remove motor from door and at the same time slide the pulley assembly from the shaft. Remove cable from pulley. Identify spacer of pulley assembly.

(9) Restrain the torque drum using the winding key, remove locking pin and allow drum to unwind fully.



MECHANISM IN UNWOUND (DOOR CLOSED) POSITION



SECTION THROUGH SPUR GEARS

VIEW OF DOOR LOOKING FORWARD

Tensator motor installation
Fig.201

2. Install Tensator Motor (Fig.201)

NOTE : Assemble all moving parts with grease (consumable material No.078).

(1) If applicable, fit the pulley shaft to the rear end plate, ensuring that the slot in the flange engages the locating pin in the end plate. Fit nut and split nut.

(2) Partially wind up motor by turning the torque drum one complete turn, using the winding key on the spline at the forward end of the torque drum; continue turning until the rigging hole in the drum coincides with the locking pin hole in the front side plate; insert locking pin, ensuring that it engages with the centre plate in the drum.

(3) Position motor in door. Do not fit attachment bolts.

(4) Slide spacer and large spur gear (complete with two bearings and spacer) on to pulley shaft with the retained bearing forward.

(5) Fit spring, engaging end of spring in hole in spur gear.

(6) Slide spacer and pulley (complete with two bearings and spacer) on to pulley shaft with the loose bearing forward. Engage hole in pulley on end of spring.

(7) Rotate pulley clockwise until stop lug on spur gear engages between stops on pulley.

(8) Fit end of cable to pulley and wind on three turns. Pre-Mod.252156, fit spacer and cable guard to pulley shaft, ensuring that the cable guard is fitted in the position shown on Fig.201. Mod.252156 fit the cable guard so that gap in guard is towards lower end of cable fairlead.

(9) Fit four motor rear attachment bolts with washers, using sealing compound (consumable material No.309) and Mod.252156, fit bolt, spacer and nut to forward attachment lug.

(10) Pass cable end through fairlead.

(11) Fit spacer and the small spur gear on the torque drum shaft with the two marked teeth engaging the single marked tooth on the large spur gear.

(12) Fit the stop lever to the torque drum shaft serrations so that the flat on the lever is exactly adjacent to the flat on the large spur gear; fit washer and nut. When Mod.252082 Pt.A is embodied (ground steel pins in shaft plug end), torque load nut to 40-50 lbf in. Fit split pin.

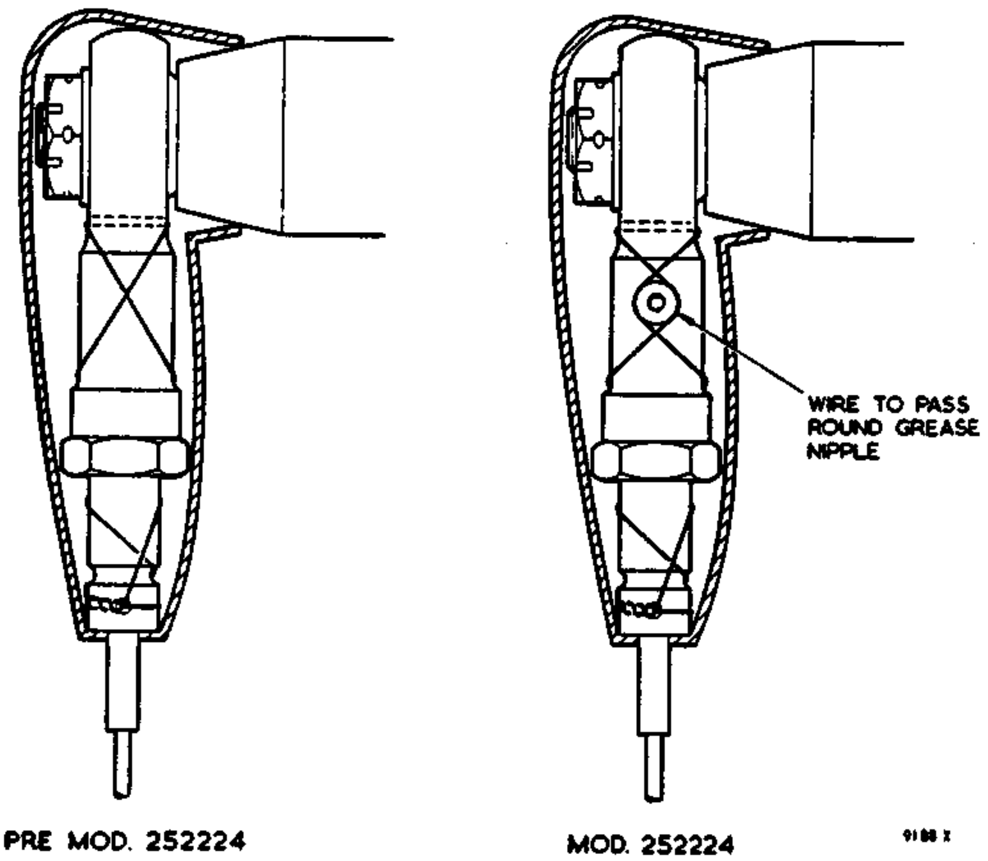
(13) Take load from motor using winding key, carefully remove locking pin and ease motor back until the flat on the stop lever contacts the flat on the large spur gear.

(14) Remove winding key.

(15) Check that the cable is wound correctly on the pulley drum and fit access panel, with the steady on the panel engaging the end of the pulley shaft.

CAUTION: DO NOT EXTEND THE CABLE MORE THAN 23.8 IN. OR THE FAIRLEAD IN THE DOOR WILL BE DAMAGED.

(16) Extend and release the cable to check that the motor functions freely and that the load to extend the cable does not exceed 180 ± 7 lbf (Pre-Mod.252582), or 210 ± 7 lbf (Mod.252582) and that the load to restrain the retracting cable is not less than 159 ± 7 lbf (Pre-Mod.252582), 184 ± 7 lbf (Mod.252582).



Wire-locking of cable eye end
Fig.202

WARNING: BE CAREFUL WHEN DISCONNECTING OR CONNECTING THE TENSATOR MOTOR CABLE. THE CABLE IS UNDER SPRING PRESSURE FROM THE TENSATOR MOTOR SPRINGS AND CAN CAUSE INJURY TO PERSONNEL. MAKE SURE THAT THE TENSION OF THE CABLE IS REDUCED TO A MINIMUM BEFORE REMOVAL OR INSTALLATION OF THE CABLE.

(17) Fit cover, locknut and eye end to the cable. Close door but do not lock. Secure eye end to door jamb, with washer and nut; lock with split pin.

NOTE: Pre-Mod.252078 Pt.C insert bolt from front; Mod.252078 Pt.C insert bolt from rear.

(18) Open door slowly and check that the motor starts to rotate when the door has opened 1.5 to 2.5 in. at the top. Adjust eye end as necessary. Tighten locknut and wire-lock eye end (Ref.Fig.202).

(19) Tighten nut on cable attachment bolt and fit split pin. Position cover over cable end.

(20) Operate door and adjust fairlead plates as necessary to obtain a clearance between cable and plates throughout door travel, and adjust fairlead rubber so that the cable is located in the slot when door is open and runs smoothly round slit throughout door travel.

(21) Fit step.

## ESCAPE HATCH - MAINTENANCE PRACTICES

### 1. Unit servicing

#### A. Renew seal

(1) Remove hatch.

(2) Ease out seal from retaining cage and discard.

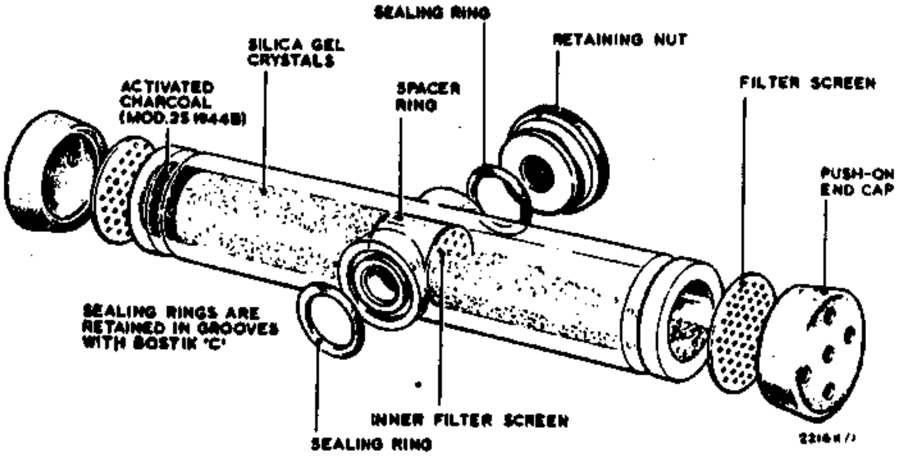
(3) Ensure retaining cage is clean. Ease new seal into cage, lining up holes in seal with holes in seal cage.

(4) Install hatch and carry out Checks/Tests after installation (see para. 2C).

#### B. Service silica gel container

(1) Unscrew knurled nut and withdraw container from recess in hatch.

(2) Detach rubber end cap and filter screen from each end of container.



Silica gel container
Fig. 201

(3) Empty the container, clean and dry the filter screens and the inside of the container.

(4) Pre mod. 251944B, insert an inner filter screen in one end and fill this end of the container with indicator type silica gel crystals while tapping the container. Fit the outer filter and rubber end cap.
Post mod. 251944B, fill with silica gel crystals leaving ½ in. to be filled with activated charcoal.

(5) Repeat operation (4) for the other end of the container.

(6) Ensure sealing rings are in position and locate container on pillar in escape hatch recess; secure with knurled retaining nut.

...Escape hatch - Maintenance practices continued

## . 2. Removal/Installation

### A. Remove escape hatch

(1) Pull release handle at top of hatch and lift hatch clear of bottom mounting brackets.

### B. Install escape hatch

(1) Check condition of seal.

(2) Check condition of silica gel crystals and renew as necessary.

(3) Ensure release handle is in release position.

(4) These operations are only necessary if a new or replacement hatch is being fitted.

  (a) Position hatch in aperture and adjust spherical bolts so that the gap between the top of the hatch and the aperture is equal to the gap between the bottom of the hatch and the aperture. After adjustment, tighten locknuts and wire-lock spherical bolts.

  (b) Check that the hatch engages firmly with its seating when the latch mechanism is operated, and that the hatch release mechanism can be operated by a pressure of 25 to 30lb on the external release button using a compression balance; if necessary, adjust hatch release mechanism by altering shimming between the bearing plate and locking catch.

(5) Engage spherical bolts at bottom of hatch into bottom mounting bracket. Push hatch firmly into fuselage aperture and push release handle to closed position.

### C. Checks/Tests after installation

If a new hatch or new seal has been fitted, proceed as follows :

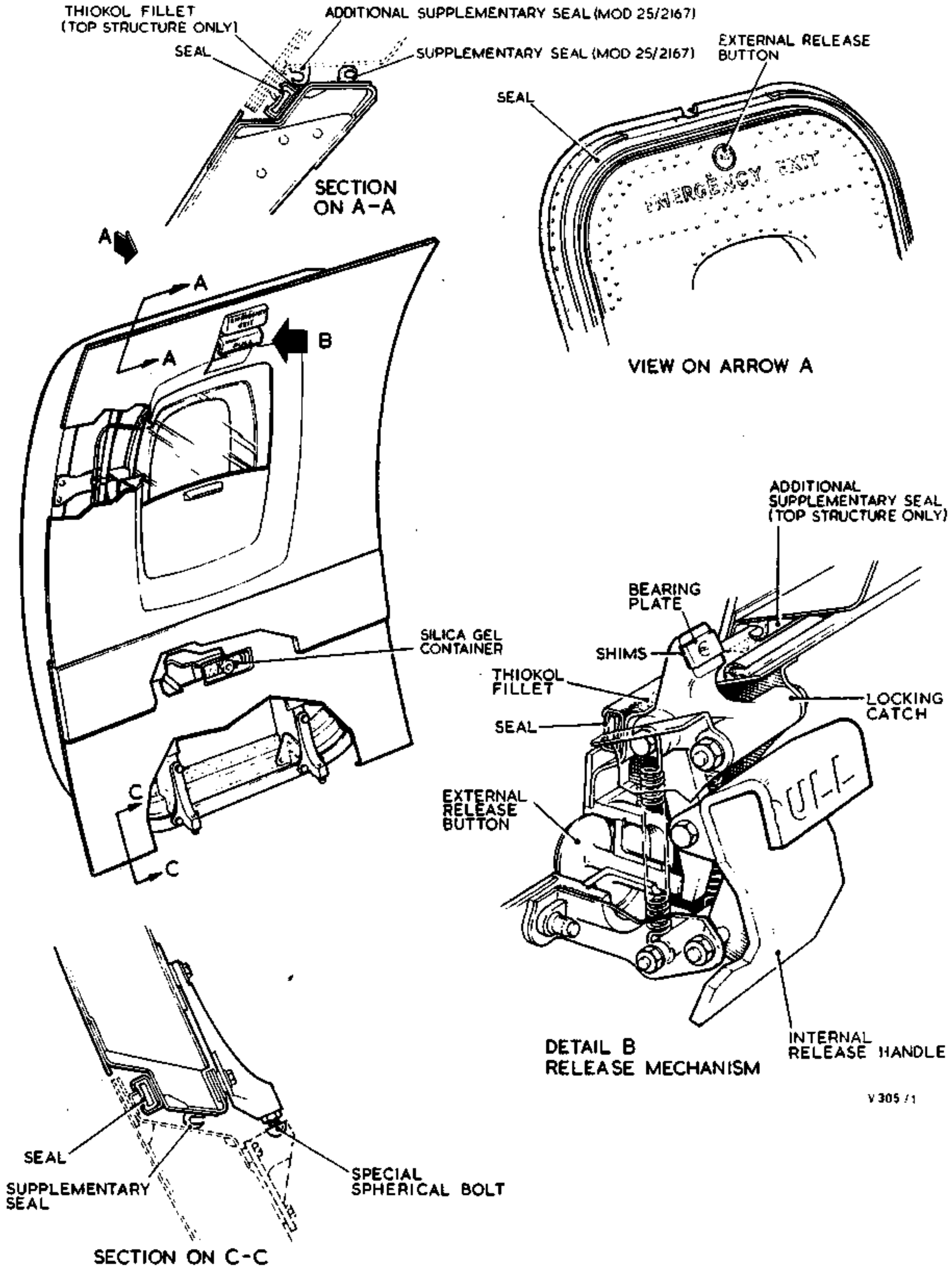
(1) Check that the clearance between hatch and surround at top and bottom is 0.03 in. min., 0.15 in. max. or, on aircraft embodying Mod. 251585, 0.10 in. min., 0.20 max. and at the sides is 0.03 in. to 0.15 in. If necessary, remove material from fuselage but maintain 0.5 in. min. rivet edge distance.

(2) Carry out cabin leak rate test (see Chapter 21, PRESSURIZATION CONTROL).

(3) During cabin leak rate test, when cabin pressure differential is 4 lb/sq.in., check that into and out of wind tolerances at sides of hatch are :

| | |
|---|---|
| Into wind ... ... ... ... ... | 0.05 in. max. |
| Out of wind ... ... ... ... | 0.15 in. max. |

NOTE : These tolerances may be exceeded over small local areas up to the maximums of 0.1 in. into wind and 0.2 in. out of wind.



Escape hatch
Fig.202

## 3. Approved repairs

### A. Renew escape hatch supplementary seals

Materials required :-

| | |
|---|---|
| Adhesive .. .. .. | EC 2210 Contact cement (3 M's Co.) |
| Cleaner .. .. .. | UK 3032. |

(1) Remove old seal and clean off bonding area; paint finish to remain.

(2) Bond new seals to hatch in accordance with Specification S26.4014 (see Chapter 20),

NOTE : Large seal to be either one continuous length, approximately 10.5 feet (3.2 metres) with a break at the latch aperture or two lengths butted at centre of hatch lower edge.

(3) To hatch surround, similarly bond new seal, approximately 9 inches (0.23 metres) long, equispaced either side of latch aperture. This seal will abutt the Thiokol fillet (see Fig 202) when the hatch is installed.

* * *

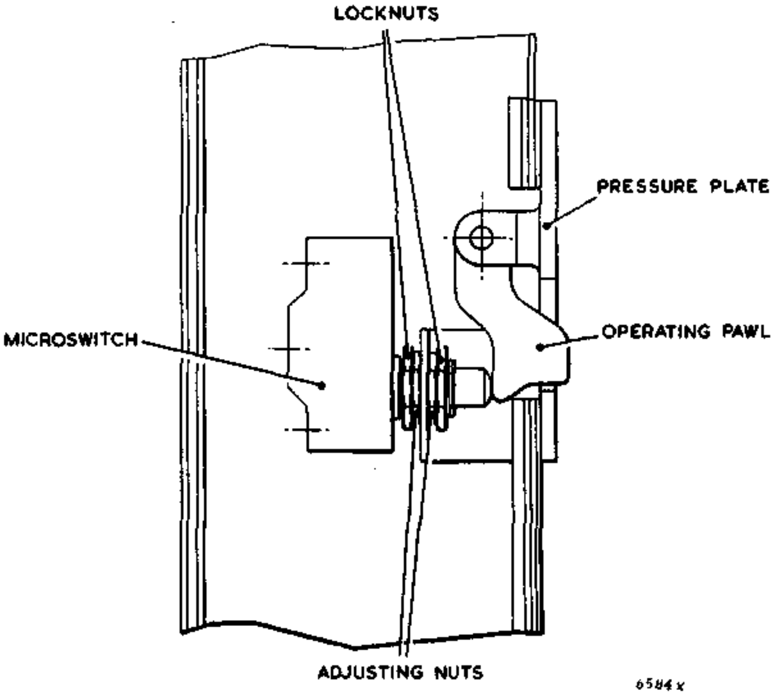
## DOOR WARNING - MAINTENANCE PRACTICES

### 1. Adjustment/Test

A. Adjust 'door closed' microswitch (Fig.201)

(1) Remove trim panel aft of door aperture.

(2) Ensure that operating pawl is free on pivot, adjust microswitch so that the switch just operates when the door is closed and locked, then reposition a further 0.1 in. towards the operating pawl, ensuring that 0.075 in. overtravel remains.



'Door closed' microswitch adjustment
Fig.201

(3) Energize d.c. busbars, open and close door and check that the ENT DOOR UNLOCKED annunciator light on MWS panel goes out when the door is closed and locked.

(4) Fit trim panel.

continued overleaf

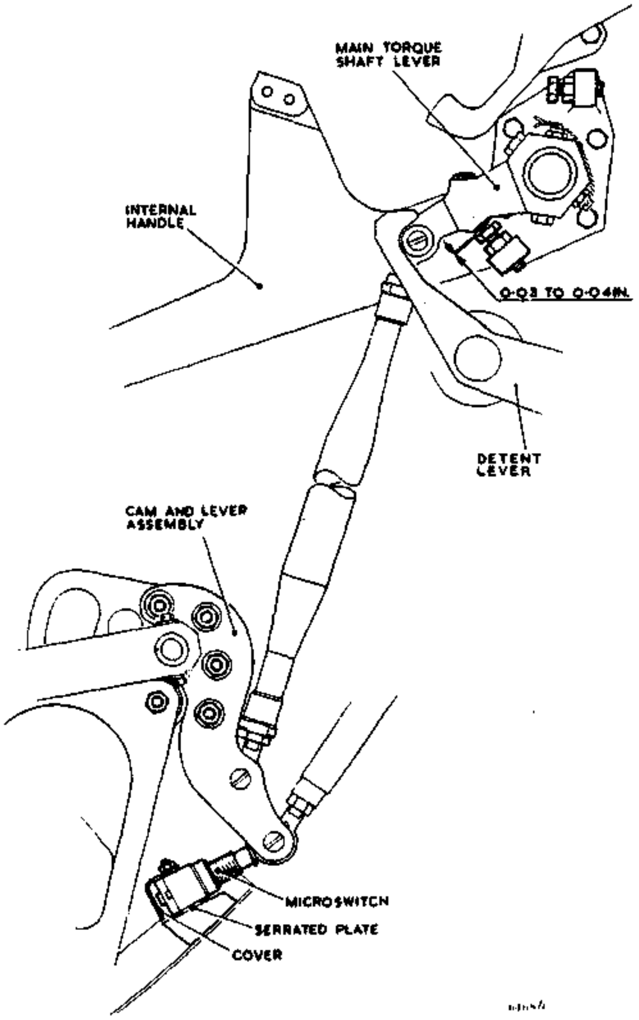
B. Adjust 'door locked' microswitch (Fig.202)

(1) Remove trim panel forward of door aperture.

(2) Check that the 'door locked' microswitch operates when the gap between the main torque shaft lever and the lower stop is 0.03 to 0.04 in. Adjust the microswitch on the serrated plate as necessary (each serration gives 0.025 in. adjustment).

(3) With door closed and locked and relevant electrical circuit energised, check that the MWS panel ENT DOOR UNLOCKED annunciator lights when the door locking mechanism is moved from the locked position, and goes out when the detent lever engages the roller and pulls the mechanism to the locked position.

(4) Fit trim panel.



'Door locked' microswitch adjustment
Fig.202

* * *

# CHAPTER

# 53

# FUSELAGE

## Chapter 53

## FUSELAGE

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+ No seperate maintenance practices

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| | 207 | Sept.78 |

## FUSELAGE DRAINAGE - DESCRIPTION

### 1. General

Moisture accumulating in various sections of the fuselage is led to drain valves and a drain tube in the keel by :-

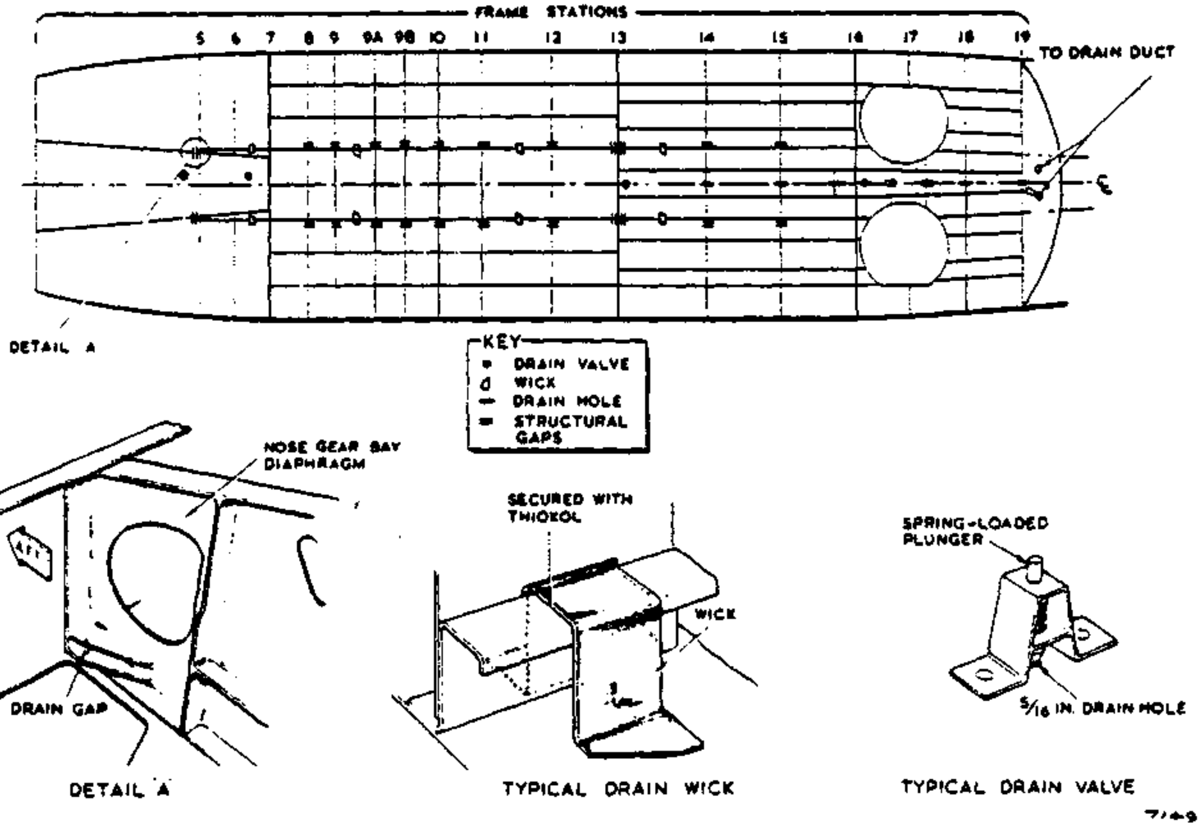
Holes drilled through certain keel frames along the centre line of the aircraft.

Apertures provided in the structure (that is, at stringer/frame inter-sections and at floor support joints).

Wicks to promote the passage of water from the upper to the lower side of the seat rail web, and to drain accumulated water from behind the rear pressure bulkhead.

### 2. Drain valve (Fig.1)

Under static conditions the valve spring holds the valve head against the support bracket and in that setting the head is clear of the drain hole. When the aircraft is pressurized, the flow of pressurizing air through the drain hole creates a negative pressure below the valve head. This occurrence and the differential pressure which exists between the fuselage interior and the ambient air, creates a load on the valve head to overcome the spring load. The valve moves downward and its conical end is forced into the drain hole, thus sealing the hole. On cessation of fuselage pressurization, the valve spring lifts the valve head clear of the hole for water drainage to recommence.



Fuselage drainage
Fig.1

## NACA INTAKE DUCT WATER TRAP - DESCRIPTION

A water trap is provided at the NACA intake duct located at the top of the front equipment bay. The trap carries away any water that may enter the duct and have a detrimental effect on electric and radar installations in the bay. A polythene pipe, clipped to the structure, drains the collected water overboard through the gap between the nose gear right-hand door and the nose skin.

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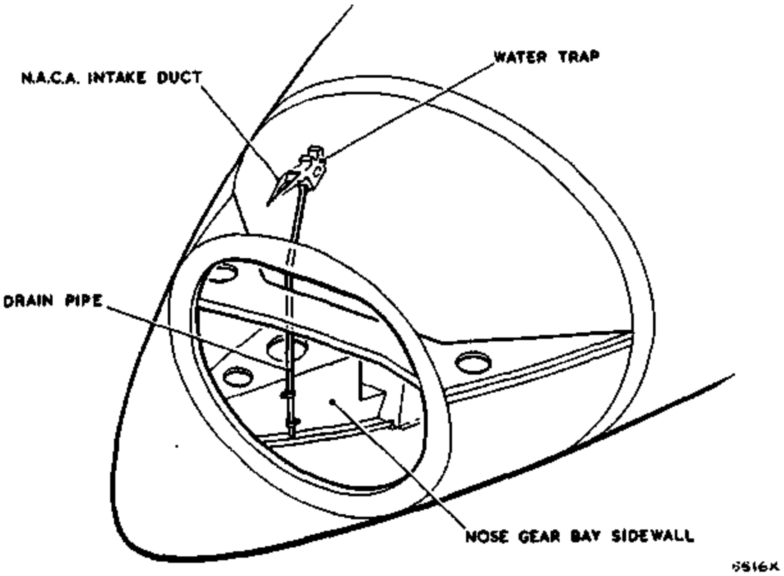


NACA intake duct water trap
Fig. 1

* * *

# WING/FUSELAGE FITTINGS - MAINTENANCE PRACTICES

## 1. Removal and installation of wing/fuselage attachment links *(Figure 201)*

| Equipment/Materials | Part/Item No. |
|---|---|
| Fuselage profile board | 25Y535A |
| Left wing profile board | 25Y331A |
| Right wing profile board | 25Y332A |
| Penetrating fluid | 260 (Chapter 20-95-201) |
| Grease | 045 (Chapter 20-95-11) |

### A. Removal

(1) Defuel the wing tanks (Chapter 12, SERVICING).

(2) If installed, drain the ventral tank (Chapter 12, SERVICING).

(3) Raise the airplane on jacks (Chapter 7, JACKING AND TRESTLING).

(4) Place adjustable trestles, with padded profile boards, under the rib 5 position of each wing.
Alternatively:
Place additional jacks, with suitable padded blocks, at the intersection of rib 4 and the rear spar intersection.

(5) Use an adjustable trestle, with padded fuselage profile board, to support the forward fuselage at frame 7.

(6) Use adjustable trestles, with padded blocks, under the beam fittings of the engine mountings adjacent to fuselage frame 20 to support the rear fuselage.

(7) Remove the wing to fuselage upper and forward fillet fairings and gain access to the wing to fuselage attachment link bolts.

(8) Apply a suitable penetrating fluid (Item 260) to the subject attachment fittings and bolts. Allow the fluid to penetrate for several hours.

**CAUTION: ONLY ONE LINK FITTING TO BE REMOVED FROM THE AIRPLANE AT ANY TIME.**

**CAUTION: EXCESSIVE BOLT MOVEMENT COULD LEAVE A RESIDUE OF CADMIUM PLATING THEREBY MAKING DETECTION OF CRACKS MORE DIFFICULT.**

(9) Adjust the trestles to reduce loading at the subject link fitting. Make sure that the attachment bolt can be rotated.

(10) Remove and retain the nuts and washers.

*NOTE: Forward attachment - Remove the bolt from the wing fitting first.*
*Rear attachment - Remove the bolt from the fuselage fitting first.*

(11) Use a suitable extractor to remove the bolts. Alternatively, place a reaction block of approximately 4lb weight on the fitting adjacent to the bolt head. Use a tube to drive the bolt out so that loadings are direct on the shoulder of the bolt.

**CAUTION: THE 'PARCO LUBRITE' MATING SURFACES ON THE SPHERICAL BEARINGS SHOULD BE MASKED TO PREVENT CONTAMINATION.**

(12) Remove the second bolt and the link assembly from the attachment together with the spherical bearings. Mask the surfaces of the spherical bearings.

### B. Inspection/Check

(1) Remove the paint from the link assemblies and the attachment lugs on the airplane and the wing (Chapter 20, STRIPPING OF PAINT).

(2) Check the attachment lugs on the fuselage and the wing for security.

(3) Visually examine the link assemblies, bolts, spherical bearings and attachment lugs on the wing and fuselage for corrosion, cracks and wear.

(4) Use magnetic particle crack detection equipment to examine the link assemblies and bolts for cracks, alternatively use a dye penetrant method (NTM, Part D, alternatively Part C ).

(5) Use magnetic particle crack detection equipment to examine the attachment lugs on the wing and fuselage for cracks where access is available. If access for MPI equipment is not easily made use the dye penetrant method. Where access is limited, use optical aids (mirrors etc.) (NTM, Part D).

(6) Use Epoxide Primer and Polyurethane Finish to repair the protective treatment on the wing and fuselage lugs and the links (Chapter 20, APPLICATION OF EPOXIDE PRIMER AND POLYURETHANE FINISH).

### C. Installation

*NOTE: Lubricate the spherical bearings, link assemblies and bolts with grease (Item 045).*

(1) Remove masking from spherical bearings. Install the spherical bearings to the forward attachments.

*NOTE: Forward attachment - Install the link assembly to the fuselage fitting first.*
*Rear attachment - Install the link assembly to the wing fitting first.*

(2) Install the link assembly and bolts to the attachment.

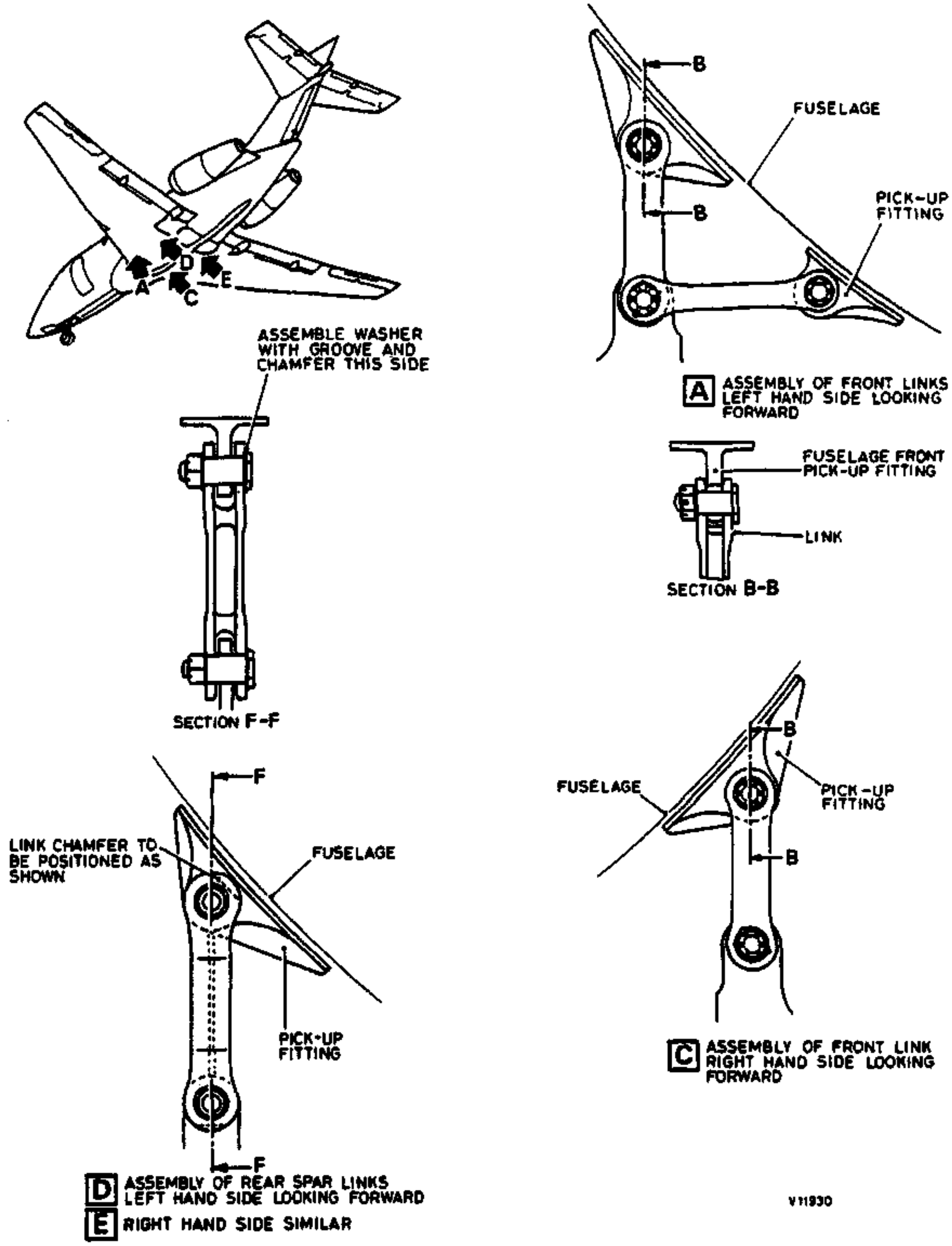
(3) Install the nuts and washers to the respective bolts and safety with split pins.

(4) Make sure that the bolt is free to rotate.

(5) Make sure working areas are clean and clear of tools and miscellaneous items of equipment.

(6) Install the wing to fuselage fairings.

(7) Remove the wing, fuselage and engine mount trestles and the padded profile boards and blocks. Lower the airplane to the ground (Chapter 7, JACKING AND TRESTLING).


A
D
E
C
ASSEMBLE WASHER WITH GROOVE AND CHAMFER THIS SIDE
SECTION F-F
B
FUSELAGE
B
PICK-UP FITTING
A ASSEMBLY OF FRONT LINKS LEFT HAND SIDE LOOKING FORWARD
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LINK CHAMFER TO BE POSITIONED AS SHOWN
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PICK-UP FITTING
B
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V11930

Installation of the wing to fuselage links

*Figure 201*

## NOSE CONE - MAINTENANCE PRACTICES

### 1. Unit servicing

### A. Lubrication

For routine lubrication data, refer to Maintenance Schedule.

### 2. Removal/Installation

### A. Remove nose cone

(1) If applicable, isolate the electrical supplies to the VOR/ILS system and the tracking lamp (see Chapter 24, GENERAL).

(2) Release fasteners and open nose cone.

(3) Disconnect bonding wires and P-clips from nose cone.

(4) If applicable, disconnect the glideslope aerial and tracking lamp cables.

(5) Support nose cone and remove shear pins or quick-release pins (Mod.251489) at hinge points.

(6) Remove shear pin at support strut pivot block.

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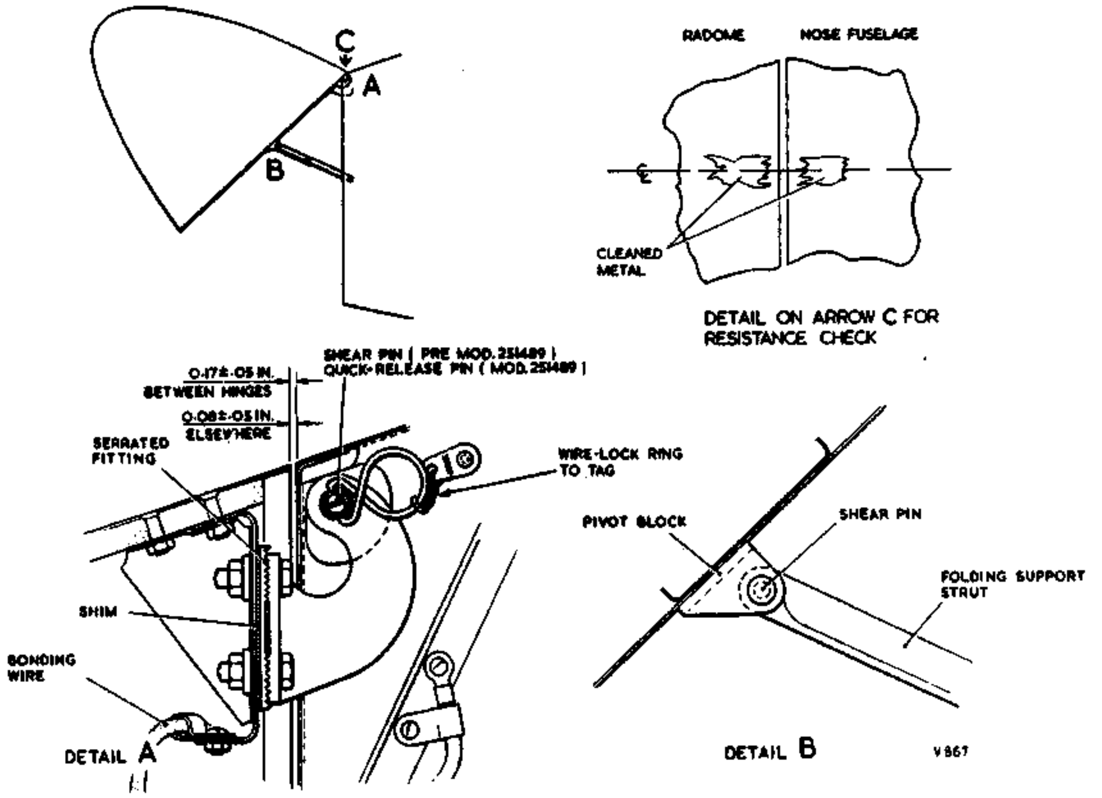

Nose cone - removal and installation
Fig.201

B. Install nose cone (Fig.201)

(1) Position nose cone and attach hinges to fuselage brackets with shear pins, washers and split pins (Pre Mod.251489), or quick-release pins (Mod. 251489); wire-lock rings of quick-release pins to locking tags.

(2) Attach support strut to pivot block with shear pin, washer and split pin.

(3) Connect bonding wires and secure P-clips to nose cone using bolts and nuts.

(4) If applicable, connect the glideslope aerial and tracking lamp cables.

(5) Close nose cone and secure fasteners. Check that the cone fairs with the fuselage skin, and that the clearance is as shown on Fig.201; adjust the shim and serrated hinge fitting as necessary.

(6) With the nose cone closed, check support strut components are in alignment.

(7) Lubricate moving joints; refer to Maintenance Schedule.

(8) Check electrical bonding resistance (see para.3).

(9) If applicable, restore electrical supplies and functionally test the VOR/ILS SYSTEM (see Chapter 34, NAVIGATION), and tracking lamp (see Chapter 33, LIGHTS).

## 3. Inspection/Check

### A. Check bonding resistance

Equipment required:- Bonding tester.

(1) With the nose cone closed and locked, check that the resistance between the top and bottom of the outer ring on the nose cone and the fuselage structure immediately behind nose cone at the aircraft centre line does not exceed 0.008 ohm.

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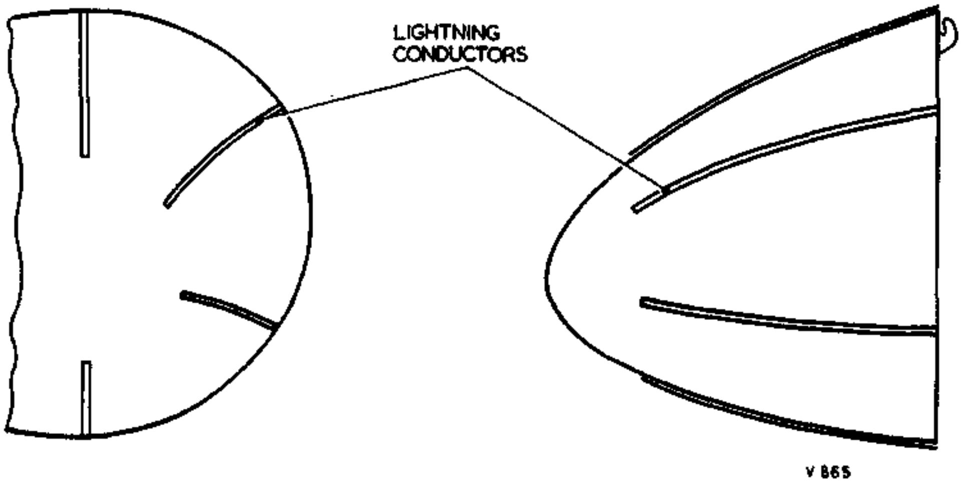

Nose cone/Radome lightning conductors (Mod.252626)
Fig.202

* * *

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## CANOPY BLISTER - MAINTENANCE PRACTICES

### 1. Removal/Installation

A. Install canopy blister (Pre Mod.25/1919) (Fig.201 and 202)

Materials required :

| | |
|---|---|
| Degreasing fluid | |
| Araldite .. .. .. | AY105 |
| Release agent | |
| 1/16 in. thick Thiokol sheet or | P100 |
| 1/16 in. thick Neoprene rubber.. | Type B |
| Cellulose or masking tape | |
| Plasticine or equivalent | |
| Thiokol .. .. .. | PR1431T |
| Thiokol .. .. .. | PR1301 |

NOTE : These instructions cover the installation of a new or repaired canopy blister and the renewal, if necessary, of the Thiokol seal. The relevant operations apply when refitting an existing serviceable canopy blister.

(1) If necessary to renew the seal, remove existing seal with extreme care as the skin thickness is only 22 swg at this position. After removal, renew protective finish in accordance with S26-3512 and S26-3504 (see Chapter 20).

(2) Check that the 11 distance pieces are bonded to the inside of the blister.

(3) If any are not bonded, proceed as follows :-

(a) Correctly locate the relevant distance pieces as shown on Fig.201.

(b) Clean and degrease the inside of the blister where the distance pieces abut, and also the tops of the distance pieces.

(c) Bond the distance pieces to the canopy blister using Araldite.

(d) To ensure that the distance pieces take up the correct angles relative to the blister, place temporary rubber washers about 0.06 in. thick under each of the 11 distance pieces and fit the blister, inserting the bolts but only doing them up sufficiently to hold the canopy in place.

(e) Allow the Araldite to cure for 24 hours minimum.

(4) Before removing the blister, mark round its outer edge using a non-corrosive wax crayon, taking care not to score the skin.

(5) Remove the blister and the temporary rubber washers.

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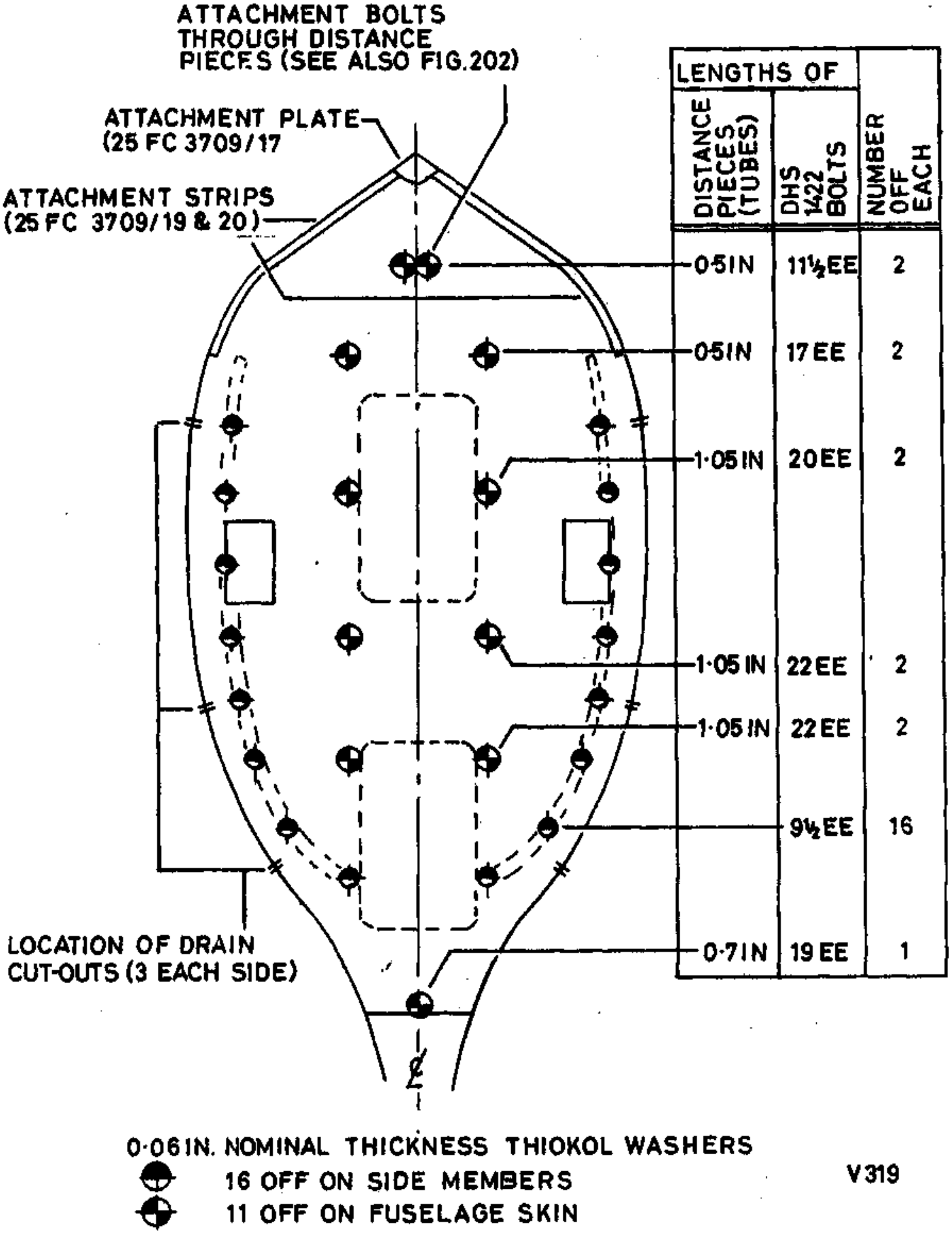
ATTACHMENT BOLTS THROUGH DISTANCE PIECES (SEE ALSO FIG.202)
ATTACHMENT PLATE (25 FC 3709/17
ATTACHMENT STRIPS (25 FC 3709/19 & 20)
LOCATION OF DRAIN CUT-OUTS (3 EACH SIDE)
℄
0·06 IN. NOMINAL THICKNESS THIOKOL WASHERS
16 OFF ON SIDE MEMBERS
11 OFF ON FUSELAGE SKIN
V319

| LENGTHS OF | | NUMBER OFF EACH |
|---|---|---|
| DISTANCE PIECES (TUBES) | DHS 1422 BOLTS | |
| 0·5IN | 11½EE | 2 |
| 0·5IN | 17EE | 2 |
| 1·05IN | 20EE | 2 |
| 1·05IN | 22EE | 2 |
| 1·05IN | 22EE | 2 |
| | 9½EE | 16 |
| 0·7IN | 19EE | 1 |

Location of attachment fittings -
Canopy blister
Fig.201

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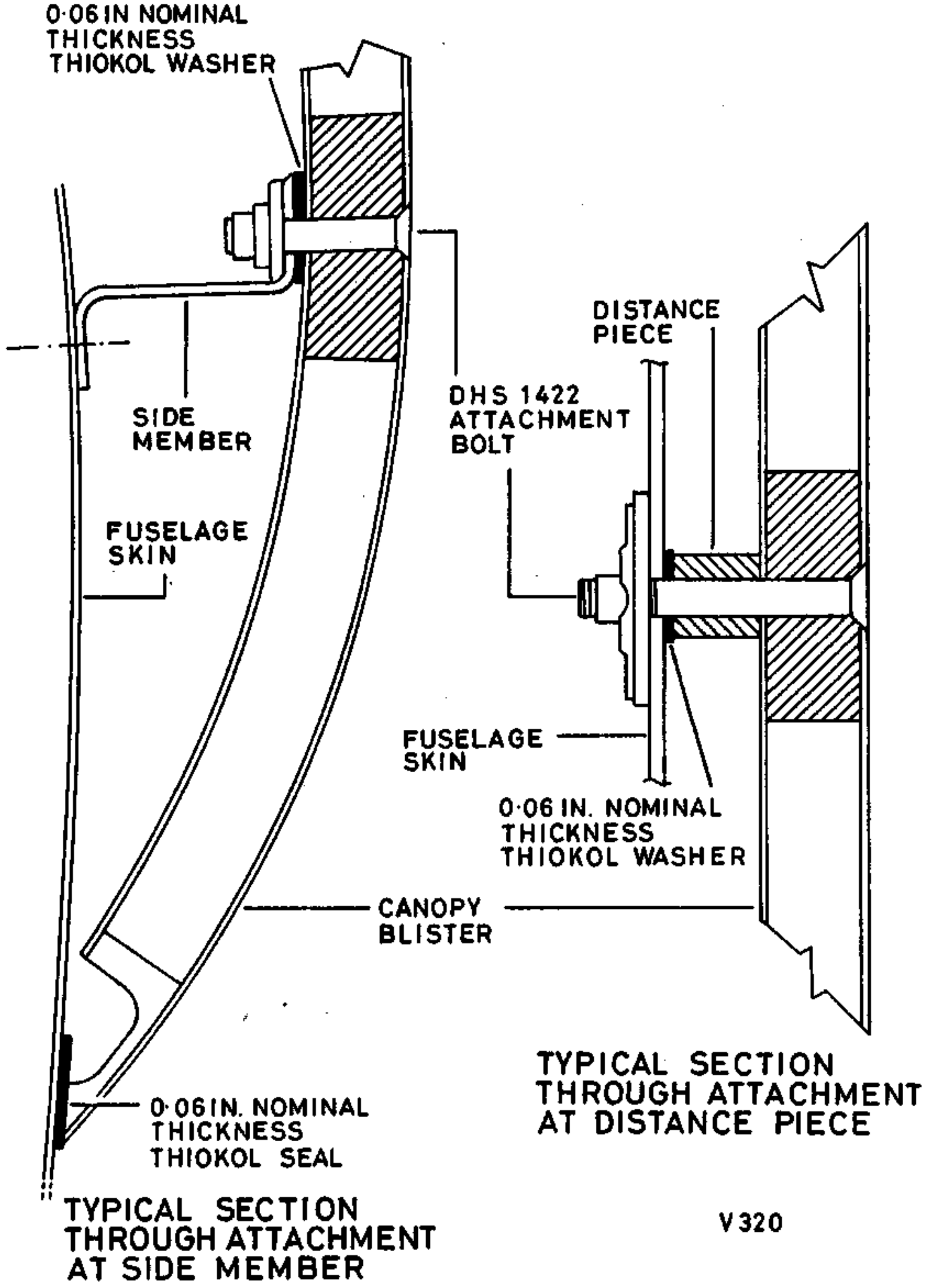
0·06 IN NOMINAL THICKNESS THIOKOL WASHER
SIDE MEMBER
FUSELAGE SKIN
DHS 1422 ATTACHMENT BOLT
DISTANCE PIECE
FUSELAGE SKIN
0·06 IN. NOMINAL THICKNESS THIOKOL WASHER
CANOPY BLISTER
0·06 IN. NOMINAL THICKNESS THIOKOL SEAL
TYPICAL SECTION THROUGH ATTACHMENT AT SIDE MEMBER
TYPICAL SECTION THROUGH ATTACHMENT AT DISTANCE PIECE
V320

Details of canopy blister attachments
Fig.202

...Canopy blister - Maintenance practices continued

(6) Cut out and fit 3/4 in. wide strips of Thiokol sheet to suit the outline drawn in operation (4). The strip is to be cut to allow the drain openings to coincide with the drain grooves on the blister. Temporarily attach the strips to the fuselage using cellulose or masking tape.

(7) Fit rings of plasticine (or similar easily extruded modelling material) about 0.1 in. thick, or sufficient to make an impression, round each of the 27 attachment bolt holes. Lightly smear the bottom of the distance pieces and the inside of the blister, where it will touch the plasticine, with release agent.

(8) Fit the blister and gently press down until the blister is bedded down on the Thiokol sheet all round (any resulting gaps are dealt with in operation (10)).

(9) Check that the distance pieces and strips at the leading edge fit.

(10) Examine for gaps between the Thiokol sheet and the edge of the blister, mark their location and note the thickness of the gap.

(11) Remove the blister and measure the thickness of the plasticine washers.

(12) Make up washers from Neoprene rubber or Thiokol sheet either :-

(a) To the correct thickness, or

(b) To the nearest thickness below the required figure, noting at the same time the discrepancy.

(13) Remove all traces of the marking crayon and bond the washers and the Thiokol strips in their correct locations with Thiokol PR1431T, in accordance with S26-1002 (see Chapter 20) building up the Thiokol to the required thickness to compensate for the gaps and discrepancies noted in operations (10) and (12).

(14) Install the blister, ensuring that the bolts are lightly smeared with release agent over the threads and lower portion of shank.

(15) Hold the canopy down firmly on the seal and tighten the attachment bolts until they just clamp. Check that all bolts are seating in the countersinks and retighten if necessary.

CAUTION : OVERTIGHTENING OF BOLTS MUST BE AVOIDED.

(16) Trim off any extruded Thiokol with a plastic spatula to give a neat surface, ensuring that the drain openings are unobstructed.

(17) Fit the distance piece and strips, 25FC 3709/17, 19 and 20 to the blister leading edge.

...Canopy blister - Maintenance practices continued

(18) Allow the Thiokol to cure (see S26-1002 in Chapter 20).

(19) Remove the bolts one at a time after 24 hours and clean the countersinks of the bolts and in the blister and refit with Thiokol PR1301 applied under the heads of the bolts in accordance with S26-1002 (see Chapter 20) and tighten as described in operation (15).

## 2. Inspection/Check

### A. Inspect canopy blister (pre and post Mod.25/1919) for delamination

NOTE : The first signs of delamination are usually a breakdown of the external paint finish.

A further sign is a sponginess of the outer glass fibre skin which can be pushed in with finger pressure when delamination has occurred.

(1) The area of delamination can best be determined by gently tapping the surface with a light metallic object (for instance a propelling pencil, coin or a short length of metal rod). The difference in sound easily differentiates areas of delamination.

NOTE : Delamination can be more accurately determined with the canopy removed and placed on a firm base.

(2) If delamination is found application should be made to British Aerospace: Aircraft Group, Hatfield.

## 3. Approved Repairs (Fig.201 and 202)

### A. Check and rectify canopy blister Thiokol washers (Pre Mod.25/1919)

Materials required :

| | |
|---|---|
| Plasticine or equivalent | |
| Release agent | |
| 1/16 in. thick Thiokol sheet or .. .. | P100 |
| 1/16 in. thick Neoprene rubber .. .. | Type B |
| Thiokol .. .. .. .. | PR1431T |
| Thiokol .. .. .. .. | PR1301 |

NOTE : These instructions presume that the seal between the blister and the fuselage does not need renewing. If it does refer to para.1. The washers and the seal are nominally 0.06 in. thick Thiokol.

The location of the washers is shown on Fig.201, there being 8 on each side of the aircraft, along the two side members, and a further 11 under the distance pieces.

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...Canopy blister - Maintenance practices continued

(1) With the blister removed place thin rings of plasticine (or an equivalent easily extruded modelling material) about 0.05 in. thick at all the 27 attachment bolt positions on the fuselage.

(2) Lightly smear the underside of the distance pieces and the blister, where it will touch the plasticine, with a release agent.

(3) Locate blister on fuselage and lightly screw down until it nests comfortably all round on the existing Thiokol seal.

(4) Carefully remove the blister and note the thickness of plasticine remaining.

(5) If the plasticine has been completely squeezed out or is less than 0.02 in. thick no action is required but all traces of the plasticine are to be removed.

(6) Where more than 0.02 in. plasticine remains, either :-

(a) Make up an additional washer to the required thickness from Thiokol or Neoprene rubber sheet and after removing all traces of plasticine bond it to the existing washer using Thiokol PR1431T in accordance with S26-1002 (see Chapter 20).

(b) Remove the old washer, taking care not to damage the fuselage skin which is only 22 swg thick at this position, and fit a new washer made up to the required total thickness from one or more pieces of Thiokol or Neoprene rubber sheet and bond these to one another and to the fuselage skin with Thiokol PR1431T.

(c) Where it is not possible to make up a washer of the correct thickness make one up to the nearest size below the required figure and then bond it to the fuselage using Thiokol PR1431T which will extrude out to the required thickness when the blister is refitted.

(7) When all the washers have been corrected, install the blister. The threads and lower part of the shanks of all the attachment bolts should be lightly smeared with release agent.

(8) Hold the blister down firmly on its seal and tighten the attachment bolts, using a screwdriver, until they just clamp. When the bolts have been screwed down check that they are all seating in their countersinks and retighten if necessary.

CAUTION : OVERTIGHTENING OF BOLTS MUST BE AVOIDED.

(9) Refit the attachment plate and strips 25.FC.3709/17, 19 and 20 to the leading edge of the blister.

(10) Allow the Thiokol to cure (see S26-1002 in Chapter 20).

...Canopy blister - Maintenance practices continued

(11) Remove the bolts one at a time after 24 hours and clean the countersinks of the bolts and in the blister and refit with Thiokol PR1301 applied under the heads of the bolts in accordance with S26-1002 (see Chapter 20) and tightened as described in operation (8).

* * *

# CHAPTER

# 55

# STABILIZERS

# CHAPTER 55

# STABILIZERS

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## STABILIZERS

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## STABILIZERS - GENERAL

Refer to Chapter 51 for details of the stabilizers structure. De-icing pipelines and electrical conduits are incorporated in the vertical and horizontal stabilizers. De-icing fluid distributor panels form the major part of the leading edges.

The joint between the horizontal and vertical stabilizer is enclosed by side fairings, a leading edge fairing and a bullet fairing. Each side fairing has a drain hole, and the joint between the side fairings and the stabilizers are sealed by rubber beading, adhesive tape and Thiokol.

The bullet fairing is bolted to the stabilizers and, in addition to enclosing the joint between the horizontal and vertical stabilizer, it encloses the elevator operating mechanism.

* * *

# HORIZONTAL STABILIZER - REMOVAL/INSTALLATION

## 1. Horizontal stabilizer

| Equipment/Material | Part/Item No. |
|---|---|
| Sling, horizontal stabilizer | 25Y229A |

### A. Removal

(1) Isolate the electrical circuits that follow:

| | |
|---|---|
| Anti collision beacon | ) |
| Airframe de-icing system | ) |
| Navigation lamp | ) Chapter 24, ELECTRICAL POWER - GENERAL |
| VHF and HF system (If installed) | ) |

(2) Position a warning notice in the flight compartment to prevent the operation of the flying control systems.

(3) Remove the elevators (Chapter 27, ELEVATOR).

(4) Remove the side fairings and the leading edge fairing enclosing the joint between the horizontal stabilizer and the vertical stabilizer.

(5) Remove the leading edge member on the vertical stabilizer, directly above the de-icing fluid distributor panel.

(6) With a suitable receptacle placed beneath the de-icing pipeline T-junction, slowly disconnect the pipelines to the horizontal stabilizer at the junction, allowing residual fluid to drain into the receptacle. Blank off pipe ends on completion.

(7) Remove the upper vertical stabilizer (VERTICAL STABILIZER).

(8) Loosen the elevator control cables at the turnbuckles in the rear equipment bay.

(9) Remove the cable guards from the elevator quadrant assembly and release the elevator control cables and attach the cables to the vertical stabilizer.

(10) Remove the elevator operating quadrant, complete with it's mounting bracket.

(11) Remove the cable guards from the two pulley bracket assemblies at the center of the horizontal stabilizer.

(12) Remove the horizontal stabilizer rear spar shrouds. Retain and identify the shims inserted above and below the inner shroud.

(13) Loosen the turnbuckles and pull the elevator trim control cables off the pulleys mounted on the underside of the horizontal stabilizer and attach the cables to the horizontal stabilizer. It is not necessary to remove the balance cable connecting left and right trim chains.

(14) Disconnect the HF aerial (if installed).

(15) Carefully pull the electrical cables through the grommets in the horizontal stabilizer.

(16) Install and secure the sling to the horizontal stabilizer. Apply sufficient tension to the sling to take the weight of the horizontal stabilizer, but do not impede the bolt removal by over tensioning.

(17) Remove split pins, nuts, washers and bolts securing horizontal stabilizer to vertical stabilizer.

(18) Remove bolts securing front and rear shear plates. Record position of washers and profile washers.

(19) Slowly apply tension to the sling and carefully remove the horizontal stabilizer. Collect and retain shims at front and rear shear plates.

B. **Installation** *(Figure 401)*

| Equipment/Material | Part/Item No. |
|---|---|
| Grease | 034 (Chapter 20-95-11) |
| Jointing compound | 307 (Chapter 20-95-301) |
| Sealant | 317 (Chapter 20-95-301) |
| Anti-fret primer | 476 (Chapter 20-95-401) |

*NOTE: Apply a thin layer of jointing compound (Item 307) to faying surfaces of brackets and structure.*

*NOTE: Assemble the horizontal stabilizer attachment bolts with grease (Item 034) under heads, on shanks and on the washer and nut faces in contact with components. Similarly assemble all other bolts with jointing compound (Item 307).*

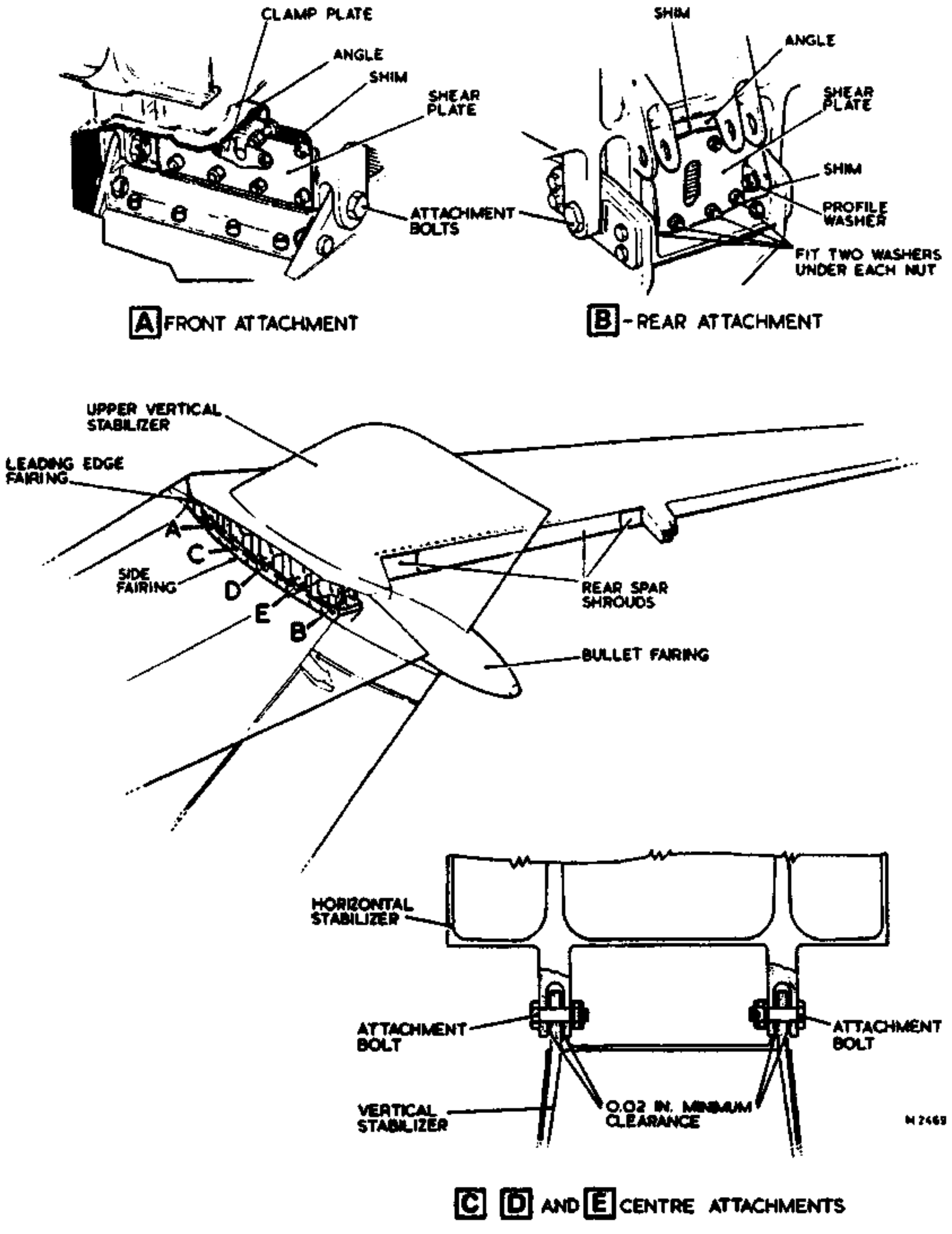
(1) Use the sling to lower the horizontal stabilizer on to the vertical stabilizer. Keep the weight on the sling.

(2) Attach the horizontal stabilizer to the vertical stabilizer with bolts, washers and nuts. Lock nuts with split pins.

(3) Make sure the shims are coated with anti-fret primer (Item 476) (Refer to Chapter 20, ANTI-FRETTING PRIMER FOR MATING SURFACES OF JOINTS OF MAJOR IMPORTANCE).

(4) Put the shims in their original positions between the shear plates and attachment angles of the front and rear attachment *(Figure 401)*.

(5) Attach the front shear plate with bolts, washers and stiffnuts.



A FRONT ATTACHMENT

B - REAR ATTACHMENT

C D AND E CENTRE ATTACHMENTS

Horizontal stabilizer.

*Figure 401.*

(6) Attach the rear shear plate with bolts, washers and slotted nuts installing two washers under the lower center nuts and profile washers under outer nuts. Split pin all slotted nuts.

(7) Do a check of the clearances between the fork fittings on horizontal stabilizer and the lugs on vertical stabilizer. The minimum clearance at any point must not be less than 0.020 in. (0.51 mm).

(8) Remove the sling.

*NOTE: A check of the incidence, dihedral and symmetry of the horizontal stabilizer is only necessary if a new or replacement horizontal stabilizer is being installed. The checks are not required if the same horizontal stabilizer is being re-installed.*

(9) Do a check of the incidence and dihedral of the horizontal stabilizer (Chapter 51, STRUCTURES - GENERAL).

(10) Do a check of the symmetry of the horizontal stabilizer (Chapter 51, STRUCTURES - GENERAL).

(11) Connect the HF aerial (if installed)

(12) Connect the elevator trim cables to chains (Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROLS).

(13) Install and secure the horizontal stabilizer rear spar shrouds with bolts. Pack above and below inner shroud with shims as required to make sure of a good fit.

(14) Install and secure the cable guards to the two pulley bracket assemblies at the center of the horizontal stabilizer.

(15) Secure the elevator quadrant assembly with bolts and nuts, lock the forward pair of bolts with split pins, and lock the aft pair of bolts by peening.

(16) Connect the elevator control cables to elevator quadrant (Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROLS).

(17) Carefully push the electrical cables through the grommets in the horizontal stabilizer.

(18) Install and secure the cable guards to the elevator quadrant with split pins.

(19) Remove blanks and connect the de-icing pipelines to pipeline in the vertical stabilizer then tighten and wire-lock the unions.

(20) Make the electric circuit (AIRFRAME DE-ICE PUMP).

(21) Prime and do a functional and leak test of the de-icing system (Chapter 30, AIRFRAME DE-ICING SYSTEM).

(22) Install the upper vertical stabilizer (VERTICAL STABILIZER).

(23) Install the vertical stabilizer leading edge member.

(24) Inspect the sealing compound seal at the horizontal to vertical stabilizer joint side fairings for deterioration and damage and if necessary renew with sealant (Item 317) to a nominal thickness of 0.06 in. (Chapter 20, THIOKOL FOR FLEXIBLE SEAL APPLICATIONS).

(25) Inspect condition of the PVC self adhesive tape around vertical stabilizer leading edge and renew as necessary.

(26) Install the leading edge fairing and the horizontal to vertical stabilizer joint side fairings to vertical stabilizer.

(27) Install the elevators (Chapter 27, ELEVATOR).

(28) Rig the elevator and elevator trim control systems aft of pulley drum (Chapter 27, ELEVATOR AND ELEVATOR TRIM CONTROLS).

(29) Make the electrical circuits opened in paragraph 1.A. (1) (Chapter 24, ELECTRICAL POWER - GENERAL).

(30) Do a functional test of the HF and VHF installations (If installed).

(31) Do a functional test of the anti-collision beacon and navigation lamps (Chapter 33, EXTERIOR LIGHTING).

## VERTICAL STABILIZER - MAINTENANCE PRACTICES

### 1. Removal/Installation (Fig.201)

### A. Remove upper vertical stabilizer

(1) Trip the following circuit breakers (see Chapter 24, GENERAL):-

On panel DA/A, VHF COMM 1
On panel DA/E, NAV (grid ref. C11)
On panel DA/E, ROTATING BEACON (grid ref. C12)

(2) Remove cover plate from left side of bullet fairing, above horizontal stabilizer; disconnect electrical leads from terminal block HE.

(3) Remove bolts securing bullet fairing and withdraw bullet fairing from vertical stabilizer.

(4) Remove the upper vertical stabilizer forward and side fairings.

(5) Remove access panel from left side of upper vertical stabilizer, and the VHF aerial cable ferrule from the root rib. Disconnect the VHF aerial connector, remove the bolt securing the 'P' clip and withdraw cable.

(6) Remove bolts and washers securing shear bracket to angle immediately aft of the rear attachment. Retain shims under washers, and shim between shear bracket and angle.

(7) Remove split pins, slotted nuts and bolts securing upper stabilizer to the horizontal stabilizer. Remove upper stabilizer.

### B. Install upper vertical stabilizer

(1) Check condition of PVC adhesive tape on horizontal stabilizer top surface and renew as necessary.

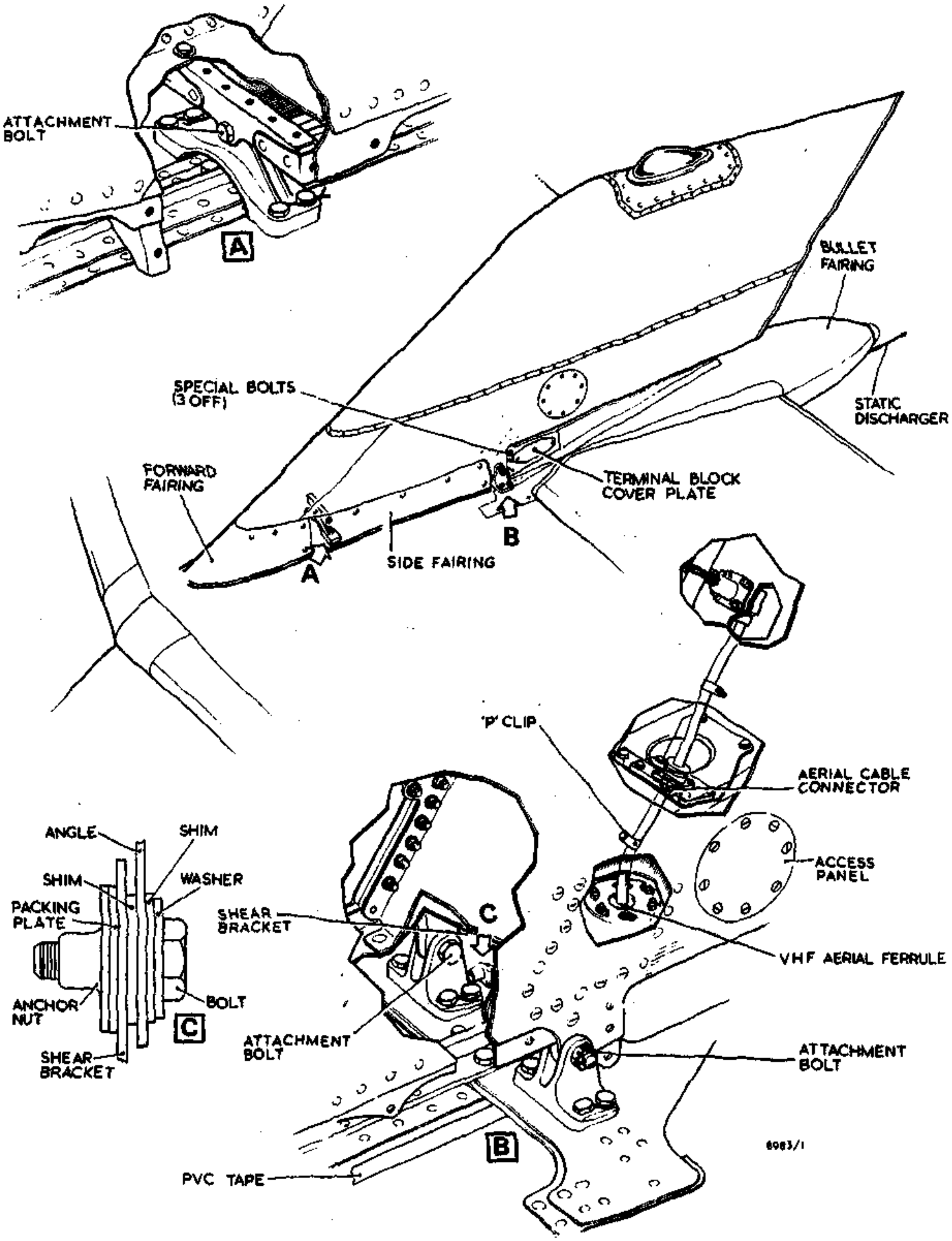
(2) Locate upper vertical stabilizer to horizontal stabilizer attachment brackets and secure with bolts and slotted nuts. Fit split pins to nuts.

(3) Secure shear bracket to angle with bolts, washers, and shims, and with shim between angle and shear plate.

(4) Feed in VHF aerial cable and connect to connector plug; secure cable with 'P' clip and fit ferrule in root rib.

(5) Secure forward and side fairings. Fit access panel to left side of upper vertical stabilizer.

(6) Position bullet fairing, and locate electrical cables in rubber grommet. Secure bullet fairing on vertical stabilizer with bolts, ensuring that the three special bolts (Pt. No.25GF4333) are fitted at the top forward edge, left and right.



Upper vertical stabilizer
Fig.201

(7) Connect electrical leads to terminal block HE; fit cover plate.

(8) Reset circuit breakers (see Chapter 24, GENERAL).

(9) Functionally test anti-collision beacon and navigation lamp circuits (see Chapter 33, EXTERIOR LIGHTING).

(10) Functionally test VHF installation (see Chapter 23, VHF SYSTEM).

D. Remove vertical stabilizer leading edge lower fairings

(1) On panel DA/D, trip circuit breaker AIRFRAME DE-ICE PUMP (grid ref. D6) (see Chapter 24, GENERAL).

(2) Remove countersunk bolts securing lower fairing to stabilizer front spar, nose rib 3 and upper fairing strap.

(3) Withdraw panel sufficiently to gain access to TKS distributor panel entry connector and support panel.

(4) With a fluid container placed under entry connector unlock and disconnect pipe coupling. Discard O-ring seal.

(5) Fit suitable blanks to entry connector and open pipe end.

(6) Removal of upper fairing, if required, is straightforward.

(7) If access to dorsal tank is required, remove bolts securing leading edge rib 3 and withdraw rib.

E. Install vertical stabilizer leading edge lower fairings

(1) Refit leading edge rib 3 and upper fairing if previously removed.

(2) Examine Thiokol seal on lower fairing attachment flanges for damage and deterioration; renew or repair as necessary in accordance with DHA 447 (see Chapter 20). Renew release agent on fairing in accordance with DHA 447 (see Chapter 20).

(3) Remove blanks from entry connector and feed pipe.

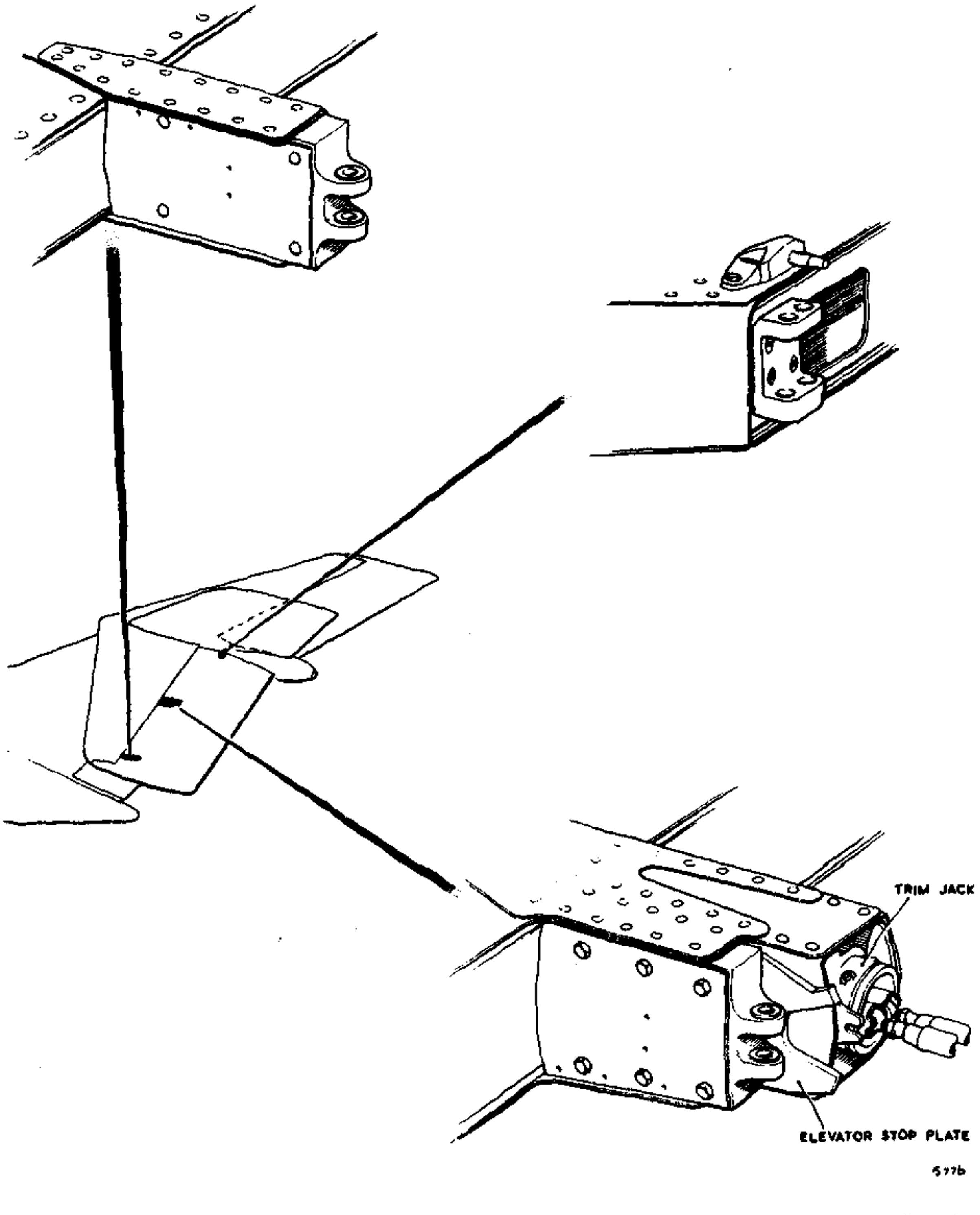
(4) Position and support panel; using new O-ring seal connect pipe coupling; tighten and wire-lock union nut.

(5) Reset circuit breakers and prime and functionally test airframe de-icing system (see Chapter 30, AIRFRAME DE-ICING SYSTEM) and check pipe coupling for leakage.

(6) Fit fairing to stabilizer and secure with bolts; tighten bolts evenly.

* * *

# ELEVATOR ATTACH FITTINGS



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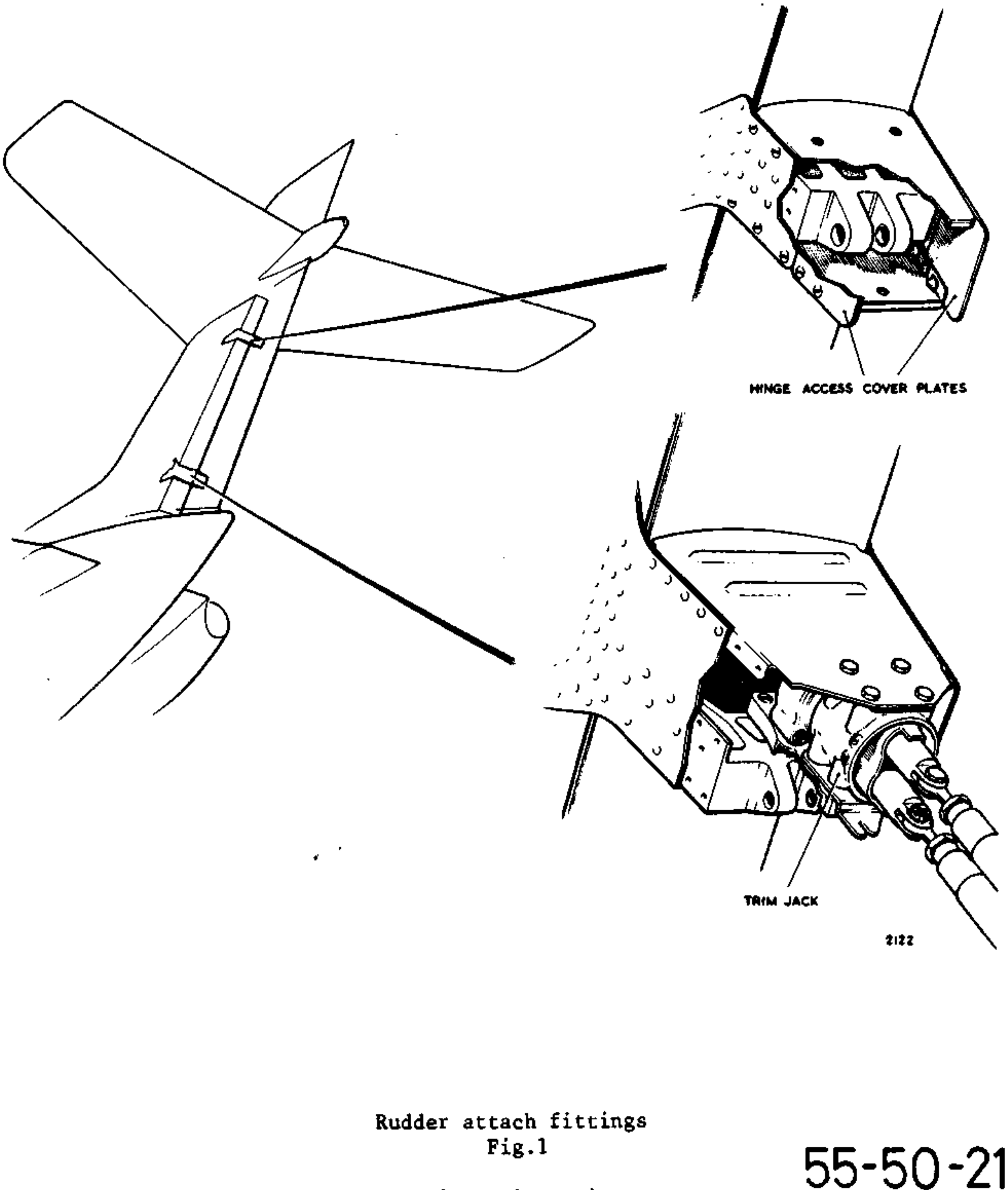
Elevator attach fittings
Fig.1

* * *

## RUDDER ATTACH FITTINGS



Rudder attach fittings
Fig.1

* * *

# CHAPTER

# 56

# WINDOWS

# CHAPTER 56

# WINDOWS

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# WINDOWS - GENERAL

Six windows are fitted in the flight compartment; panels A, B and C, left and right. Panels A and C are fixed, panel B can be opened to provide direct vision.

Panels A are electrically-heated panels of glass and Vinyl construction. Panels C are of sandwich construction with an air space between inner and outer Perspex panels. Panels B have a main panel of sandwich construction similar to panel C, with an additional inner Perspex panel mounted in a fibreglass frame.

The cabin windows, including the window in the escape hatch, are of similar construction to panel C.

To prevent misting and contamination by tobacco tars, the air spaces, between the sandwich panels and also at panel C, between the centre perspex component and the inner perspex component, are connected to silica gel containers. Mounted at the top of each panel B is a container holding silica gel crystals and activated charcoal. Panels C and the cabin windows, except the escape hatch window, are connected to a container mounted in the front luggage compartment. The container is filled with silica gel crystals and an air filter with a renewable element is fitted to the air inlet connection.

The escape hatch window is connected to a silica gel container similar to that fitted to panel B (see Chapter 52, ESCAPE HATCH).

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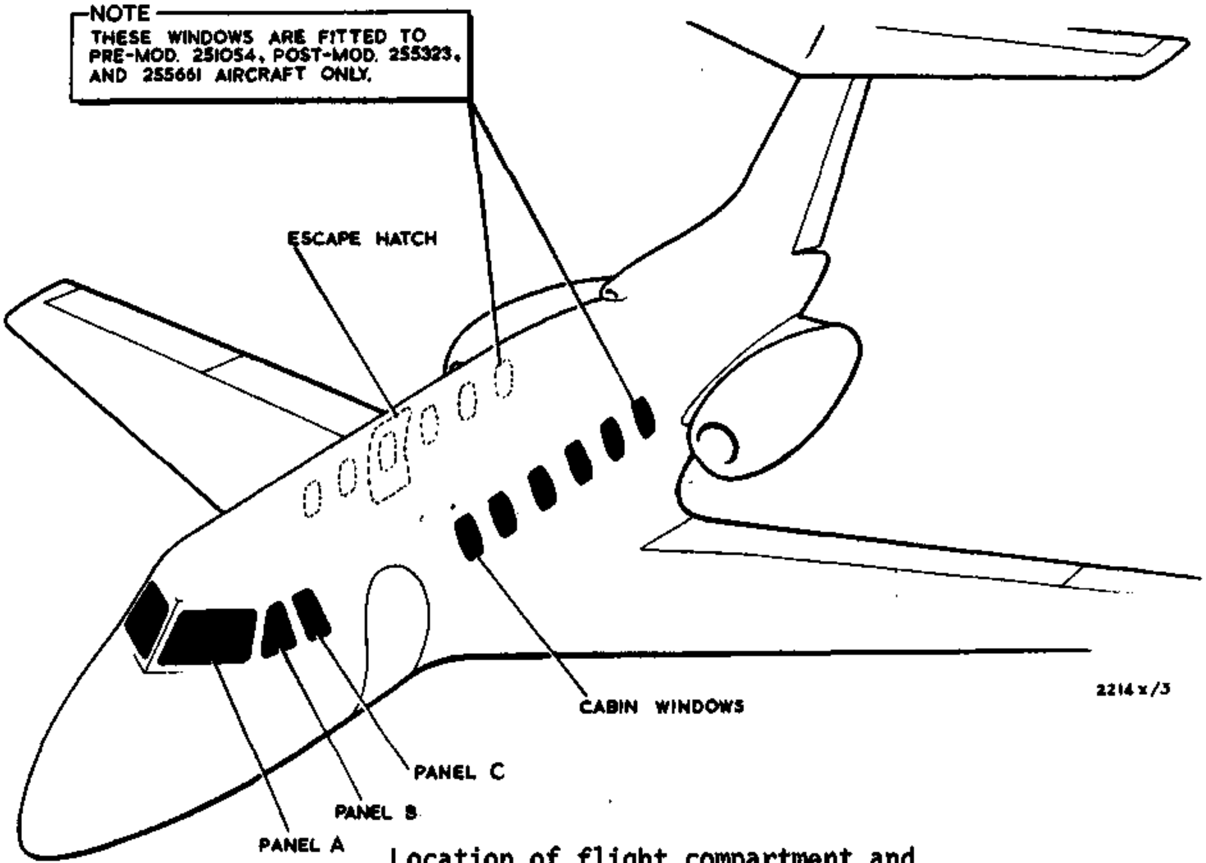
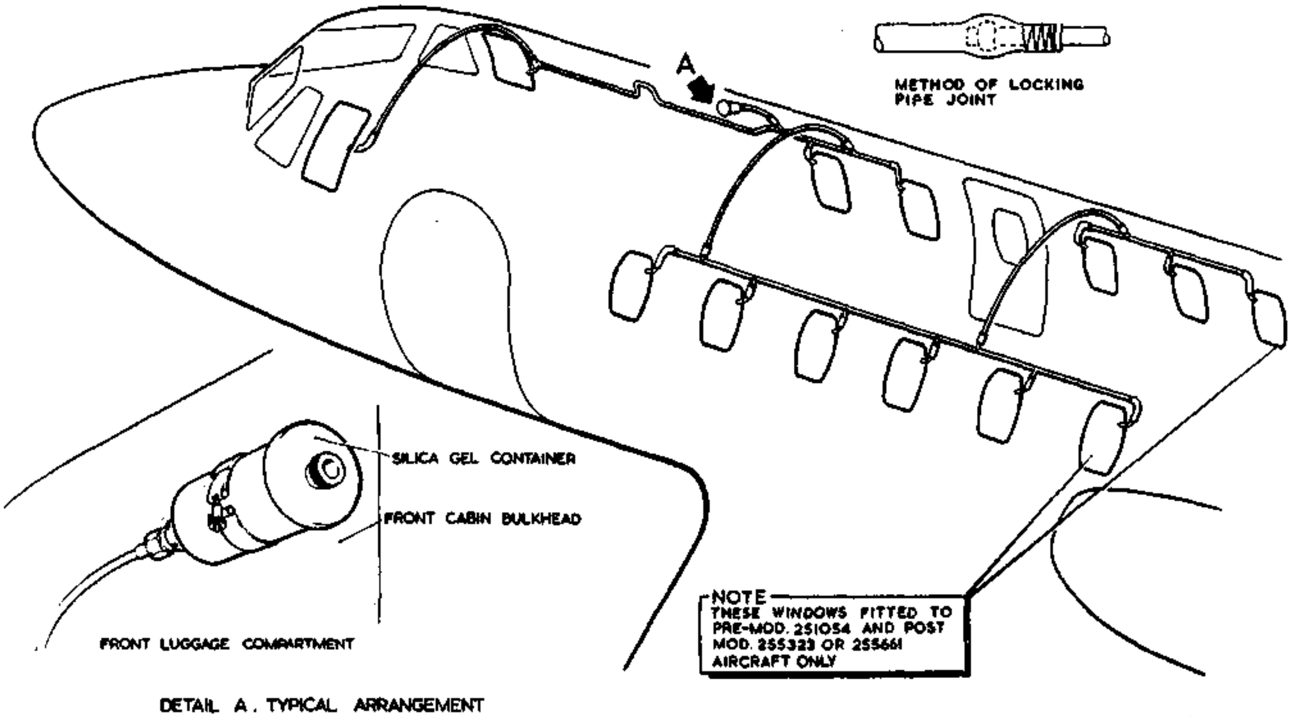

NOTE
THESE WINDOWS ARE FITTED TO PRE-MOD. 251054, POST-MOD. 255323, AND 255661 AIRCRAFT ONLY.
ESCAPE HATCH
CABIN WINDOWS
2214x/3
PANEL C
PANEL B
PANEL A

Location of flight compartment and passenger compartment windows
Fig.1

...Windows - General continued


A
METHOD OF LOCKING PIPE JOINT
SILICA GEL CONTAINER
FRONT CABIN BULKHEAD
FRONT LUGGAGE COMPARTMENT
DETAIL A. TYPICAL ARRANGEMENT
2225X/5

NOTE
THESE WINDOWS FITTED TO PRE-MOD. 251054 AND POST MOD. 255323 OR 255661 AIRCRAFT ONLY

Window dry air system
Fig.2

* * *

# WINDOWS - MAINTENANCE PRACTICES

## 1. Unit servicing

| Equipment/Materials | Part/Item No. |
|---|---|
| Silica gel crystals | 602 (Chapter 20-95-601) |

### A. Service silica gel container - window panel 'B'

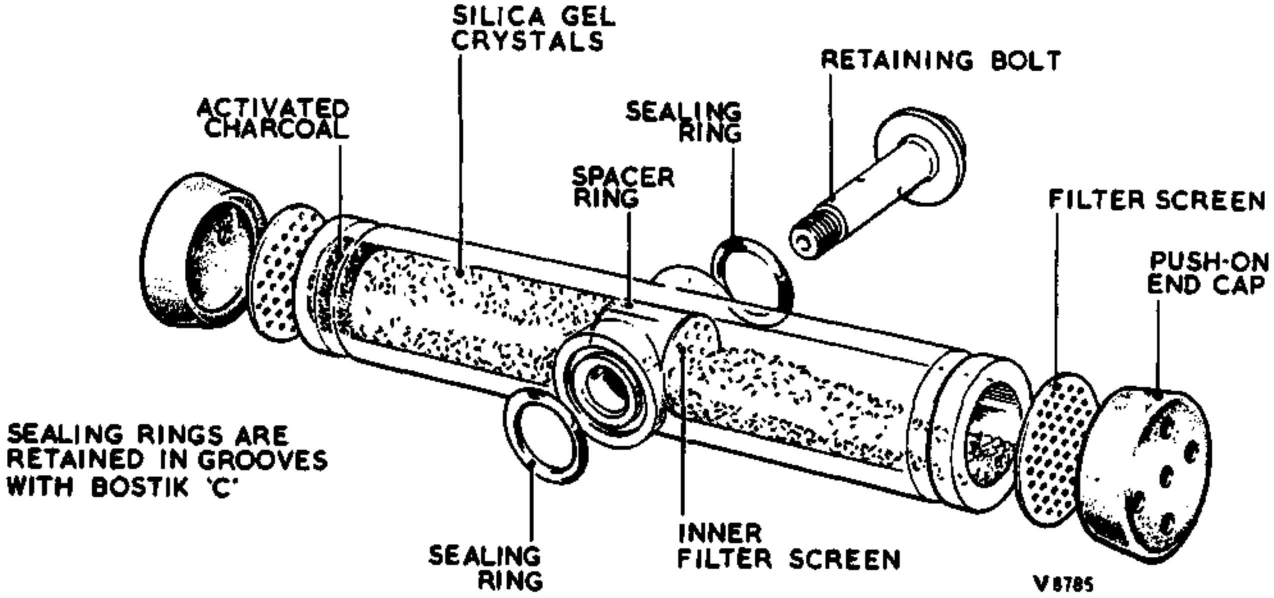
(1) Unscrew the retaining bolt and withdraw the container from the mounting on the window frame.

(2) Detach the end cap and filter screen from each end of the container.

(3) Empty the container, clean the inner and outer filter screens and dry the inside of the container.

(4) Insert an inner filter screen in one end and fill this end with indicating type silica gel crystals (Item 602) to within 0.5 in. of the top whilst tapping the container. Fill the space left with activated charcoal. Install the outer filter screen and rubber end cap. Repeat these operations on the opposite end of the container.

(5) Position the container on the window mounting bracket, make sure the sealing rings are in position and secure with the retaining bolt.



Silica gel container
*Figure 201*

**B. Service silica gel container - window panel 'C' and cabin windows** *(Figure 202)*

(1) Unscrew the union nut of the self sealing coupling, hold the container and unscrew the clamping strap knurled nut.

(2) Unscrew the air filter.

(3) Remove the end cap and empty the container.

(4) Clean and dry the container making sure the filters are not blocked.

(5) Fill the container with fresh indicating type silica gel crystals.

(6) Check the condition of the rubber seal and renew as necessary. Reinstall the end cap.

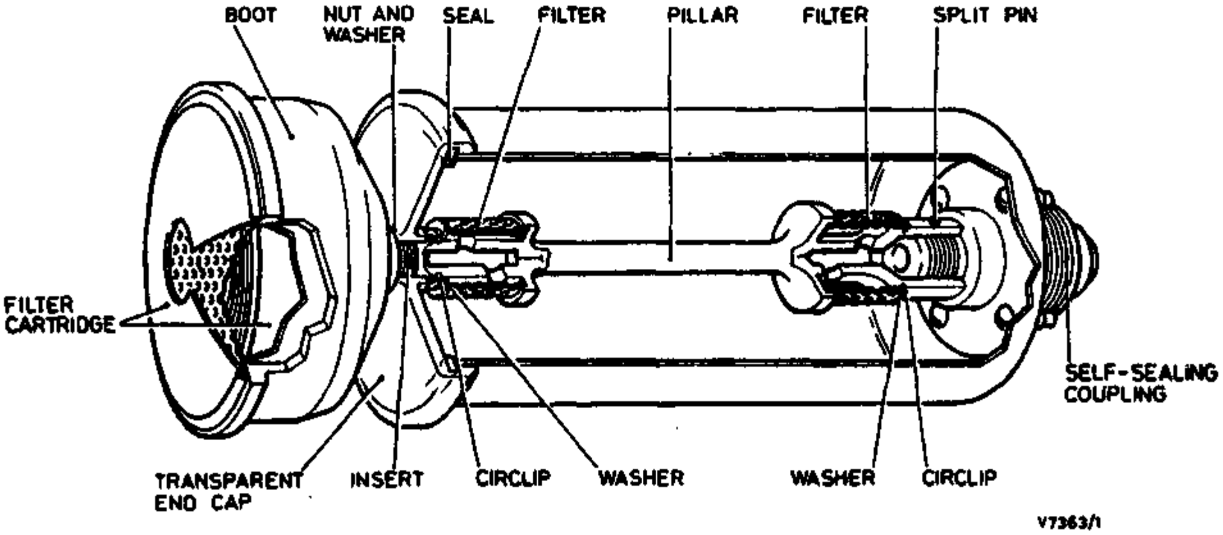
(7) Reinstall the air filter.

(8) Position the container in its stowage and install, tighten and wire-lock the self sealing coupling union nut. Tighten the clamping strap knurled nut and wire-lock.

**C. Service filter - window panel 'C' and cabin windows silica gel container** *(Figure 202)*

(1) Remove the filter boot assembly from the end of the silica gel container.

(2) Release the filter cartridge from the edge of the boot.



Silica gel container and filter
(window panel 'C' and cabin windows)
*Figure 202*

(3) Remove and discard the filter cartridge.

(4) Remove the nut and washer from the insert and remove the insert from the boot.

(5) Make sure the boot has no cracks.

(6) Wash the boot, insert, nut and washer with a mild liquid detergent. Rinse the items in clean fresh water and make sure the items are dried.

(7) Secure the insert into the boot with the nut and washer.

(8) Install a new filter cartridge into the boot.

(9) Assemble the filter boot assembly to the silica gel container.

## 2. Cleaning/Painting

### A. Clean internal surfaces of perspex sandwich windows

(1) Remove window (Chapter 56, WINDOW PANEL 'B' or 'C' or PASSENGER COMPARTMENT WINDOWS, as applicable).

(2) Pour 40 millilitres (approximately 1.5 fluid ounces) of a mild solution of any household liquid detergent into the air spaces through the plug holes. Manipulate the window so the cleaning liquid covers all inside surfaces. Leave for 10 minutes.

(3) Empty, then wash out 3 times using clean tap water.

(4) Wash a further 3 times using de-ionised water.

(5) As applicable, remove the blanking screw or Chekaleke plugs from the inner panel and dry by passing a gentle flow of air through the window for 15 minutes.

**CAUTION: CARE MUST BE TAKEN TO MAKE SURE THAT AT NO STAGE DURING THE CLEANING PROCEDURE MUST AIR OR FLUID BE ADMITTED BY PRESSURE INTO THE WINDOW INTERIOR, OR SEPARATION OF THE PANEL JOINTING MAY RESULT.**

(6) Examine the window and repeat the procedure if any contamination remains. As applicable, install blanking screw or Chekaleke plugs to inner panel.

(7) Install window (Chapter 56, WINDOW PANEL B. WINDOW PANEL C or PASSENGER COMPARTMENT WINDOWS).

## WINDOW PANEL A - DESCRIPTION

The panel is constructed of three layers of glass, comprising a semi-toughened outer component, fully toughened main component, and a strengthened inner component, interspaced with layers of Vinyl. A metal insert is fitted into the extended Vinyl edge of the panel. Holes for the panel securing bolts are bushed, to prevent over-clamping.

Busbars are fired onto the inner surface of the outer glass component and the whole surface covered by a gold film heating element. Overheat and temperature control sensing elements are fitted between the outer Vinyl layers, so that two Vinyl layers insulate the sensing elements from the gold film. To minimize the possibility of having to reject a panel during manufacture because of failure of an overheat or temperature control sensing element, both these elements are duplicated. In many panels both elements are serviceable thus providing a spare. The procedure for connecting the duplicate element, is described in Chapter 30, WINDSHIELD ELECTRICAL DE-ICING SYSTEM - Approved Repairs. Should a sensing element fail during manufacture, however, its relevant terminal is completely blanked off.

The panel has a Thiokol seal fitted to both the inside and outside mating flanges and is secured to the canopy structure by countersunk bolts, four clamping strips fitted with anchor nuts and stiffnuts. At the lower edge some of the panel bolts pass through a guard for the windshield wiper.

### Edge delamination

NOTE : Some panels 'as received' or after storage may show signs of edge delamination by wrinkling of the release tape inserted between the laminations during manufacture.

This wrinkling is normal and will not give cause for rejection of the panel.

* * *

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# WINDOW PANEL A - MAINTENANCE PRACTICES

## 1. Removal/Installation *(Figure 201, Figure 202)*

| Equipment/Material | Part/Item No. |
|---|---|
| Hermetal, double bond | 326 (Chapter 20-95-301) |
| Jointing compound | 307 (Chapter 20-95-301) |

### A. Remove panel A

(1) Open, safety and tag the following circuit breakers or remove fuses (as applicable):

| Panel | Label |
|---|---|
| DA/D | WINSCREEN WIPER LH |
| DA/D | WINSCREEN WIPER RH |
| DA/D | W/SCREEN HEAT CON LH (fuse) |
| DA/D | W/SCREEN HEAT CON LH (fuse) |
| DA/C | W/S HEAT CONTROL LH (fuse) |
| DA/C | W/S HEAT CONTROL LH (fuse) |
| DA/C | No.2 ALT CONTROL (fuse) |

(2) Unscrew the bolts and remove the sun visor mountings; retain the distance pieces.

(3) Remove the instrument panel coaming (Chapter 31, INSTRUMENT PANELS, GENERAL).

(4) Remove the de-misting ducts, ventilation fan and punkah louvre assemblies (Chapter 21, AIR SUPPLY AND DISTRIBUTION).

(5) Unscrew the bolts and remove the window panel trim.

(6) Disconnect the electrical cables from the panel, note the locations and remove the cable links from the busbar terminals.

(7) Remove the panel attachment bolts, noting the positions of the bolts *(Figure 202)*, from the clamping strip assemblies, and withdraw in turn each of the assemblies.

(8) Support the panel, remove the stiffnuts from the remaining attachment bolts, and withdraw the panel.

### B. Checks/Tests before installation

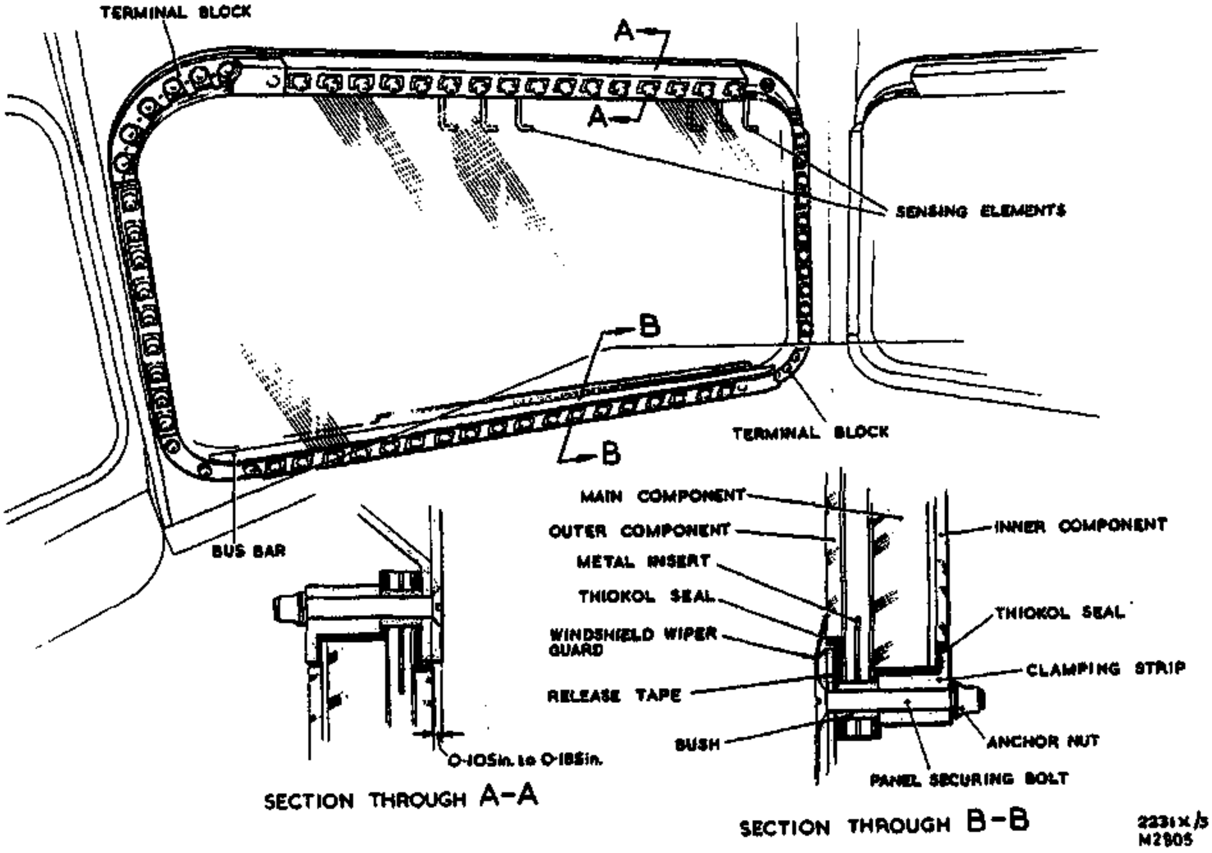
*NOTE: Resistance values given relate to a screen temperature of 20 degrees C (68 degrees F).*

(1) Check that the resistance between the window panel busbars terminals 1 and 4, 2 and 5 and 3 and 6 is 22.5 to 29.5 ohms.

(2) Examine the Hermetal seating, on the window panel receiving frame, for damage. If necessary, restore the seating (Chapter 20, HERMETAL DOUBLE BOND).

(3) Examine the window panel frame surround for corrosion and any other damage. Rectify as necessary.

*NOTE: Panel serviceability is not affected by any wrinkling of the release tape.*



Window panel A installation
*Figure 201*

## C. Install panel A

(1) Make sure the seal on the window panel is not damaged, and the window frame is clean.

(2) Apply jointing compound to panel attachment bolts, to prevent ingress of moisture.

(3) Position the panel in the window frame.

**CAUTION: WHEN INSERTING THE PANEL ATTACHMENT BOLTS MAKE SURE NO JOINTING COMPOUND COMES INTO CONTACT WITH THE VINYL LAYERS OF THE PANEL.**

(4) In turn, position each clamping strip, insert securing bolts through the panel and engage in clamping strip anchor nuts.

(5) Insert remaining bolts through the panel and install stiffnuts.

**CAUTION: DO NOT OVERTIGHTEN THE PANEL ATTACHMENT BOLTS.**

(6) Alternating from side to side, lightly tighten the panel attachment bolts.

(7) Torque tighten ALL the windscreen bolts to 40 lb. in. (4.42 Nm) in the same alternating side to side sequence as paragraph (6).

(8) Make sure that the outer face of the panel is between 0.105 in. (2.67 mm.) and 0.185 in. (4.7 mm.) out of wind *(Figure 201)*.

(9) Connect the cable links to the panel busbar terminals.

(10) Connect the electrical cables to the panel terminals, and install the terminal block covers.

(11) Position the window panel trim, insert the bolts and tighten.

(12) Position the distance pieces and the sun visor mountings, insert the bolts and tighten.

(13) Install the de-misting ducts, ventilation fan and punkah louvre assemblies (Chapter 21, AIR SUPPLY AND DISTRIBUTION).

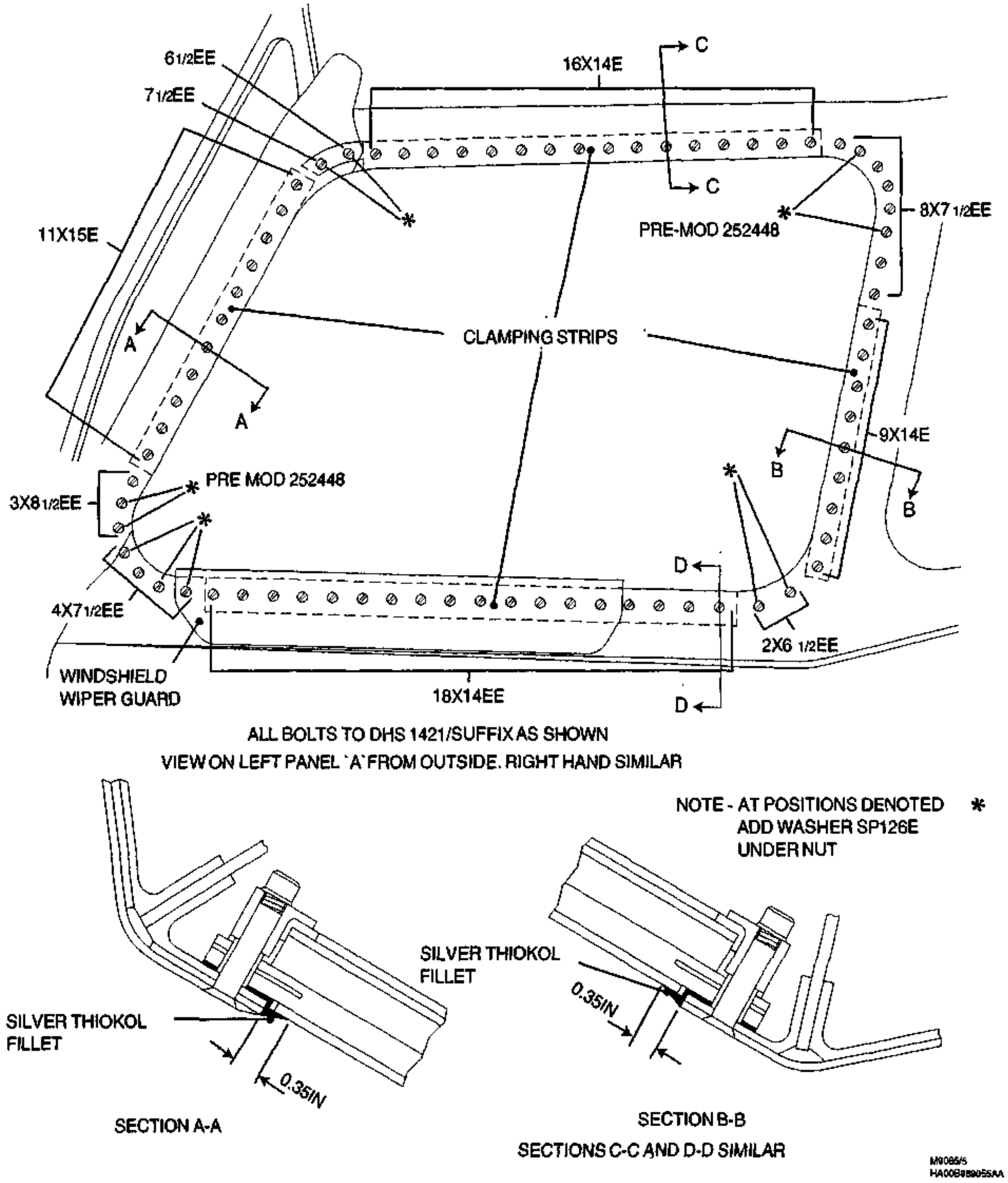
(14) Install the instrument panel coaming (Chapter 31, INSTRUMENT PANELS - GENERAL).

(15) Reset the circuit breakers and install fuses.

(16) Do a windshield electrical anti-icing system function test (Chapter 30, ICE AND RAIN PROTECTION).

(17) Refer to *Figure 202*. Do a torque loading check (40 lb.in.) of the windscreen attachment bolts (torque loaded at paragraph 7).

(18) Do a cabin leak rate test (Chapter 21, PRESSURIZATION CONTROLS).



ALL BOLTS TO DHS 1421/SUFFIX AS SHOWN
VIEW ON LEFT PANEL 'A' FROM OUTSIDE. RIGHT HAND SIMILAR

NOTE - AT POSITIONS DENOTED *
ADD WASHER SP126E
UNDER NUT

Window panel A attachment bolts
*Figure 202*

## 2. Inspection Check

### A. All window panels

(1) for information on the extent of allowable damage to the window panel A, refer to the Structural Repair Manual, Chapter 56-10-11.

## 3. Approved repairs

### A. Damage rectification

(1) To avoid further deterioration which could lead to panel replacement, it is recommended that all damage, scoring, crazing etc. should be rectified in accordance with the Structural Repair Manual as soon as possible.

## WINDOW PANEL B - DESCRIPTION AND OPERATION

### 1. Description

The window, opening rearward on roller tracks, is constructed of a panel comprising two Perspex components interspaced by a Perspex reinforcing ring and rubber packing. The panel is housed in two frame castings which are attached by two jointing plates; sealing of the panel in the frames is effected by Boscoprene. A rubber sealing strip is attached to the outer edge of the window to provide an effective seal with a Thiokol seal on the canopy structure, when the window is closed.

Locking of the window is effected by two locking pins, actuated by the window operating handle, sliding into lock plates attached to adjacent structure; a spring assembly fitted to the lock linkage provides positive locking.

The window has its own dry air system comprising a Silica gel container, fitted to the upper frame jointing plate, which connects via drillings in the attachment bolt, frame and panel, to the air space between the two Perspex components of the panel.

A mounting for the fitment of a sun visor is attached to the lower frame jointing plate.

### 2. Operation

The window is opened by pulling the operating handle upward to release the locking pins and then sliding it rearward until the front roller engages with the leaf springs at the rear of its track.

* * *

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# WINDOW PANEL B - MAINTENANCE PRACTICES

## 1. Unit servicing

| Equipment/Material | Part/Item No. |
|---|---|
| Philip's neoprene cement | Local supply |
| Adhesive | 336 (Chapter 20-95-301) |
| Sealant | 314 (Chapter 20-95-301) |
| De-greasing agent | 230 (Chapter 20-95-201) |
| Methylated spirits | 227 (Chapter 20-95-201) |
| Silicon-carbide abrasive paper (grade 150) | Local supply |

### A. Renew seal

Pre-mod.251427 and Pre-mod.25A308A

(1) Remove the seal and old adhesive from the channel in the window frame.

(2) Attach the new seal to the window frame with adhesive (Item 336).

*NOTE: Make sure the ends of the new seal are at the top of the window frame.*

Mod.251427 and Pre-mod.25A308A.

(3) Remove the seal and old adhesive from the window panel frame.

(4) Remove the chalk from the new seal.

(5) Apply a coat of Phillip's neoprene cement to the seal and the frame, leaving the channel clear; allow cement to dry.

(6) Apply a second coat of cement to the seal and the frame allowing cement to become tacky.

(7) Position the seal on the frame and apply pressure until set.

Mod.25A308A.

(8) Remove the existing seal and adhesive from the window panel frame. If the window panel frame has a groove remove the sealant from the groove, taking care not to damage the frame.

(9) Clean the surface of the window panel frame with de-greasing agent (Item 230).

(10) If the window panel frame has a groove, fill the groove with sealant (Item 314) and allow the sealant to dry.

(11) To aid adhesion of the new window seal to the window panel frame, the mating face of the new seal is to be cleaned and prepared as follows:

(a) Clean the mating face with methylated spirits (Item 227)

(b) Roughen the mating surface using silicon-carbide abrasive paper (grade 150) to produce a matt surface.

(c) Remove all traces of dust from the seal.

(12) Apply sealant (Item 314) to the mating face of the seal.

(13) Position new seal on the window panel frame and apply pressure until the sealant is set. Remove all surplus sealant.

## 2. Removal/Installation *(Figure 201)*

| Equipment/Material | Part/Item No. |
|---|---|
| Oil, mineral light | 126 (Chapter 20-95-101) |
| Sealant | 314 (Chapter 20-95-301) |

### A. Remove window

(1) Remove the stop bolt from the rear track.

(2) Open the window and slide to rear of tracks. If unable to move the window to end of tracks, remove nuts and washers from bottom rollers, using the stop bolt hole and a front track attachment hole as access holes for a screwdriver to hold the roller bolts.

(3) Lift the window from the tracks (or from bottom rollers) and slide the window from the upper roller bearing pin.

### B. Check/Tests before installation

(1) Examine the rubber seal on the outer edge of the window for damage and deterioration. If necessary renew the seal (paragraph 1.A.).

(2) If a new window is to be installed:

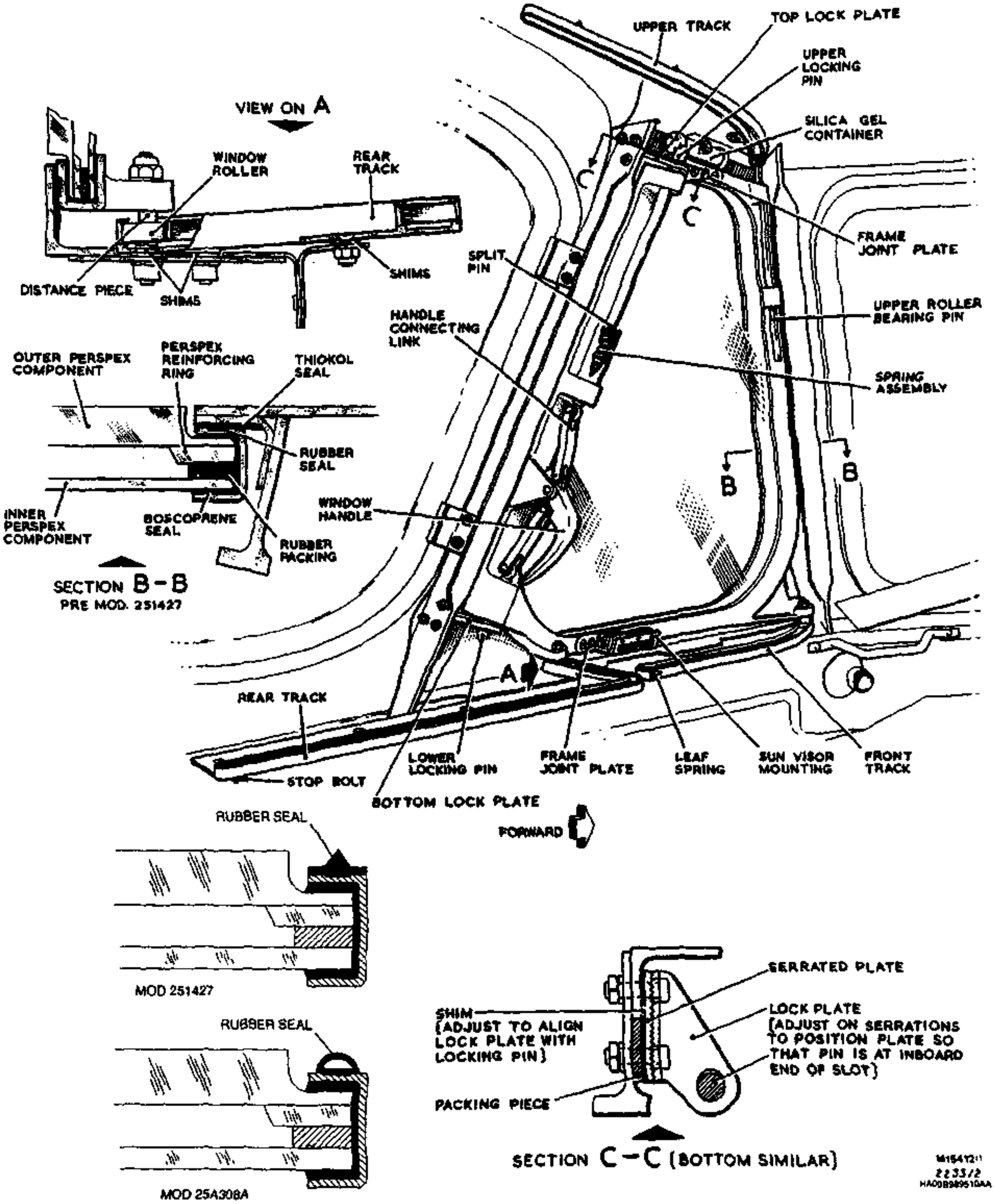
(a) Transfer the sun visor mounting to the new panel.

(b) If applicable, remove the bottom rollers, bolts and distance pieces from the tracks and install to the old panel. Remove rollers, bolts and distance pieces from new panel and install to the tracks.

(3) Pre-mod.25A308A.
Examine the window aperture seal. If necessary repair any damage to the seal with sealant (Item 314).

(4) Mod.25A308A.
Examine the window aperture seal as follows:

(a) Make sure there is a flat, even surface to the sealing compound.



*Window panel B removal/installation*

*Figure 201*

(b) Make sure the depth of sealing compound has a constant dimension of 0.25 in. when measuring from the outside airplane skin to the surface of the sealing compond at various positions around the window aperture.

*NOTE: It is recommended that a simple tool (a flat plate cut to the shape of the window aperture) is made to assist in the above operation.*

(5) Mod.25A308A. Repair any damage using sealant (Item 314). Allow time for the sealant to dry.

### C. Install window

(1) Position window and engage the upper roller bearing pin in the lugs on the window frame.

(2) Engage the window rollers in their respective tracks, or if applicable engage lugs on roller bolts, making sure that a distance piece is installed between each roller and lug. Install washers and nuts to the roller bolts.

(3) Install stop bolt, washer and nut to rear track and, if applicable, the attachment bolt, washer and nut to the front track.

(4) Lubricate the window locking mechanism with oil (Item 126).

(5) Close and lock the window and make sure that:

(a) The lock plates are correctly adjusted (Detail C).

(b) The outer face of the window is not out of wind more than 0.15 in. (Pre-mod.251999) or 0.03 in. (Mod.251999), and is not into wind more than 0.04 in.

(6) Open window and make sure that when the stop bolt is contacted, the leaf spring in the front track restrains the window.

(7) Close and lock the window, and check for ease of operation.

(8) Do a cabin leak rate check (Chapter 21, PRESSURIZATION CONTROL).

## 3. Inspection/Check

### A. Inner, center and outer panels

(1) For information on the extent of allowable damage to the window panel B, refer to Structural Repair Manual, Chapter 56-10-21.

## 4. Approved repairs

### A. Damage rectification

(1) To avoid further deterioration which could lead to panel replacement, it is recommended that all damage, scoring, crazing, etc., should be rectified in accordance with the Structural Repair Manual as soon as possible.

# WINDOW PANEL C - DESCRIPTION

The panel is constructed of two Perspex components interspaced by a Perspex reinforcing ring (pre Mod. 25/2410) and rubber packing. Moulded to the rubber packing is a connection for the dry air system pipeline.

The panel is sealed by Boscoprene, or Thiokol PR 1301 alternative, moulded around the window receiving frame and a rubber seal fitted around the panel outer edge.

Four retaining angles, each fitted with a rubber pad, secure the panel.

* * *

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# WINDOW PANEL C
# MAINTENANCE PRACTICES

## 1. Removal/Installation *(Figure 201)*

| Equipment/Material | Part/Item No. |
|---|---|
| Parting agent | 223 (Chapter 20-95-201) |
| 22 s.w.g. copper wire or waxed No.18 thread | Local supply |

### A. Remove window panel C

(1) Remove window trim panel (Chapter 25, WINDOW TRIM PANEL ASSEMBLIES).

(2) Disconnect the dry air system pipeline from the window.

(3) Blank off the pipeline and window connection.

(4) Support the window, remove the retaining angles and withdraw the window.

### B. Install window panel C

(1) Examine the window frame surround for corrosion and any other damage. Rectify as necessary.

(2) Examine the condition of the outer edge seal on the window and the seal on the window receiving frame for damage and deterioration. For rectification of the frame seal refer to paragraph 3.B.

(3) Do a check of the window panel fit on its seating. If there is an incorrect fit on the seal that allows the window to stand off the seal when it is assembled, or there is a gap in the continuity of the seal, the seating should be rectified in accordance with paragraph 3.B.

(4) Examine rubber strips on the window retaining angles for damage and deterioration.

(5) Apply parting agent (Item 223) to the seal on the window receiving frame to prevent the window adhering to the seal on assembly.

(6) Put the window in position, centrally in the frame.

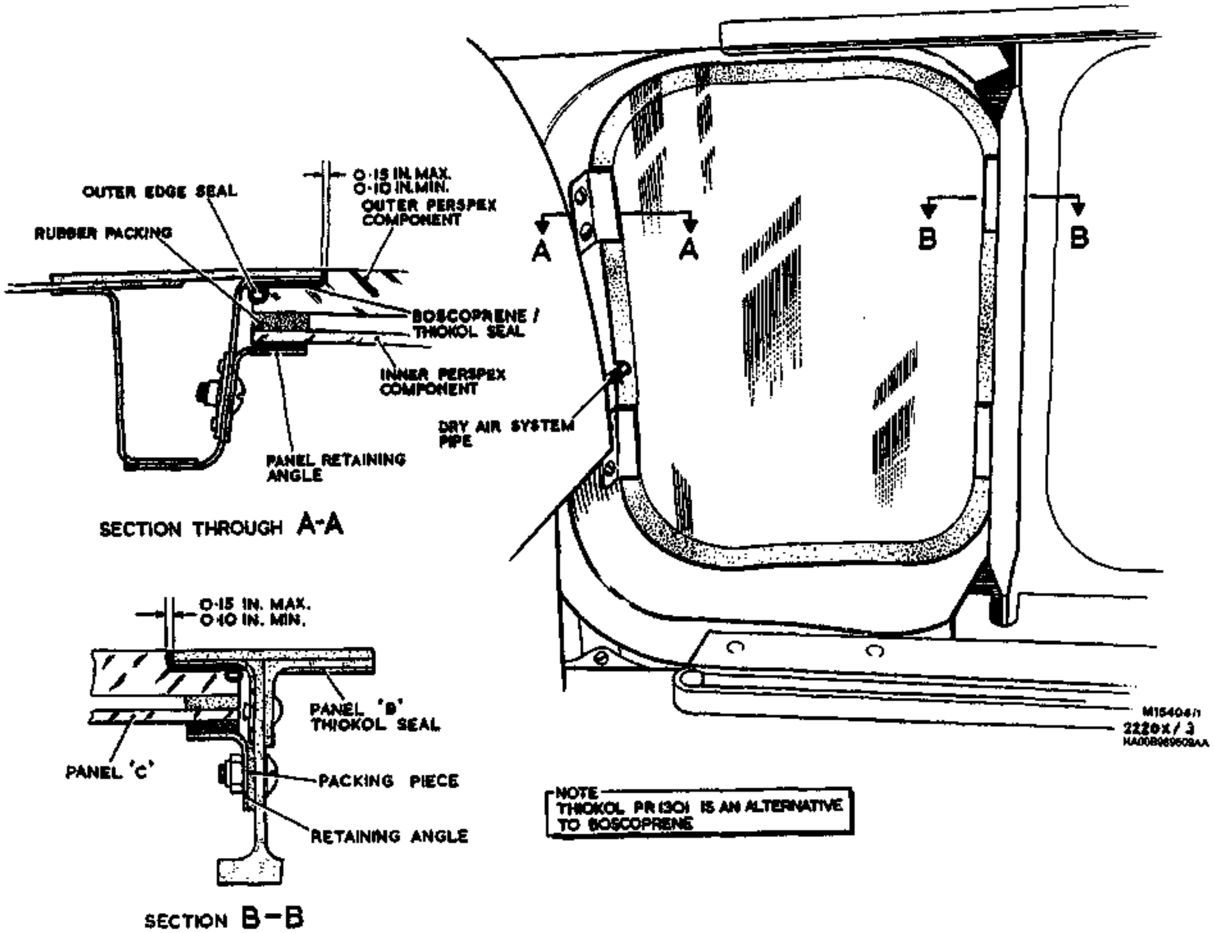
(7) Put the retaining angles into position and insert securing bolts.

(8) Make sure the window is mating with the seal on the window receiving frame and that the rubber strips on the retaining angles are in firm contact with the window, then evenly tighten the window securing bolts.

(9) Make sure the gap between window frame and window is within limits given on *Figure 201.*

(10) Make sure the outer face of the window is not more than 0.040 in. into or out of wind.

(11) Remove the blanks and connect the dry air system pipeline to the window connection and secure with five turns of 22 s.w.g. copper wire or waxed 18 thread.



NOTE
THIOKOL PR 1301 IS AN ALTERNATIVE TO BOSCOPRENE

Window panel C installation
*Figure 201*

*NOTE: Do not use an adhesive to stick the two rubber Chekaleke drain plugs in the sandwich window inner component.*

(12) Do a cabin leak rate check (Chapter 21, PRESSURIZATION CONTROL).

(13) Examine the condition of the dry air system silica gel crystals and renew as necessary (Chapter 56, GENERAL).

## 2. Inspection/Check

### A. Inner and outer window panels

For information on the extent of allowable damage to the window panel C, refer to the Structural Repair Manual, Chapter 56-10-31.

## 3. Approved repairs

### A. Damage Rectification

To avoid further deterioration which could lead to a panel replacement, it is recommended that all damage, scoring, crazing, etc., should be rectified in accordance with the Structural Repair Manual as soon as possible.

### B. Rectification of the seal.

| Equipment/Materials | Part/Item No. |
|---|---|
| Sealant | 313 (Chapter 20-95-301) |
| Sealant | 321 (Chapter 20-95-301) |
| Parting agent (Sodium alginate) | 223 (Chapter 20-95-302) |
| White spirit (solvent) | 219 (Chapter 20-95-301) |
| Cleaner | 229 (Chapter 20-95-201) |
| Wire brush | Local supply |

*NOTE: The sealant used for the repair is to be of the same type as the existing seal.*

(1) Clean the surface of the seal thoroughly (Item 219 or Item 229) and roughen it with a wire brush.

(2) Apply the correct sealant (Item 313 or Item 321) to the prepared surface to repair the damage to the seal.

*NOTE: For use of sealant (Item 321) refer to Chapter 20, SEALING OF PERSPEX AND LAMINATED GLASS WINDOWS ETC. USING BOSCOPRENE 2100.*

*NOTE: For use of sealant (Item 313) refer to Chapter 20, SEALING OF PRESSURE CABINS WITH BERGER CHEMICALS LTD. 1400 SERIES POLYSULPHIDE RUBBERS.*

(3) Coat the mating surface of the window panel and the outer edge seal with parting agent (Item 223) and secure the window panel in the correct position until the sealant has cured.

(4) Trim off any surplus sealant.

## PASSENGER COMPARTMENT WINDOWS - DESCRIPTION

The windows are constructed of two Perspex components interspaced by a Perspex reinforcing ring and rubber packing. Moulded to the rubber packing is a connection for the dry air system pipeline.

The window is sealed using Thiokol PR 1301, moulded around the window receiving frame and a rubber seal fitted around the window outer edge.

Four brackets, each fitted with a rubber pad, secure the window.

* * *

# PASSENGER COMPARTMENT WINDOWS MAINTENANCE PRACTICES

## 1. Removal/Installation *(Figure 201)*

### A. Remove window

(1) Remove the window trim panel assembly.

(2) Disconnect the dry air system pipeline from the window.

(3) Blank off the pipeline and the window connection.

(4) Support the window, remove retaining brackets and distance pieces, and withdraw the window.

### B. Install window

| Equipment/Material | Part/Item No. |
|---|---|
| Parting agent | 223 (Chapter 20-95-201) |
| 22 swg copper wire or waxed No. 18 thread | Local supply |

(1) Examine the window frame surround for corrosion and any other damage. Rectify as necessary.

(2) Examine the condition of outer edge seal on the window and the seal on the window receiving frame for damage and deterioration. For rectification of frame seal refer to paragraph 3.B.

(3) Do a check of the fit of the window panel on its seating. If there is any lack of fit on the seal that allows the window to stand off the seal when it is assembled, or there is a gap in the continuity of the seal, the seating should be rectified in accordance with paragraph 3.B.

(4) Examine rubber strips on the window retaining brackets for damage and deterioration.

(5) Apply parting agent (Item 223) to the seal on the window receiving frame to prevent the window adhering to the seal on assembly.

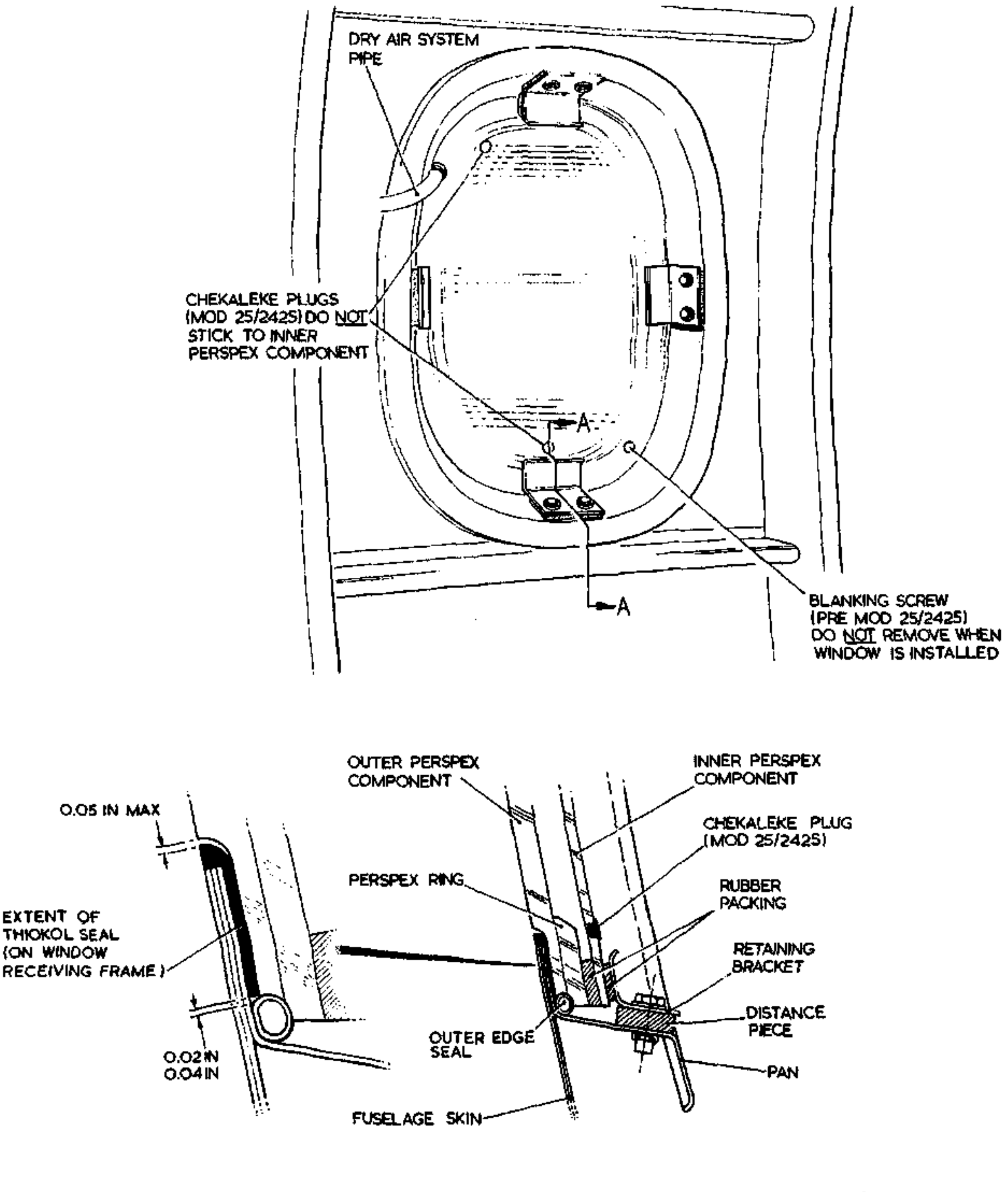
(6) Put window in position, centrally in frame.

(7) Put retaining brackets into position, install distance pieces, and insert bolts and washers.

*NOTE: If the removed window was to Pre-mod.252425 standard and a Mod.252425 window is being installed, it will be necessary to modify the retaining brackets (to allow for increased panel thickness) by elongating the bolt holes 0.060 in. max. towards the heel.*

(8) Make sure the window is mating with the seal on the window receiving frame and that the rubber strips on the retaining brackets are in firm contact with the window, then evenly tighten the window securing bolts.

(9) Make sure the gap between the window frame and window is within limits on *Figure 201.*


DRY AIR SYSTEM PIPE
CHEKALEKE PLUGS (MOD 25/2425) DO NOT STICK TO INNER PERSPEX COMPONENT
A
A
BLANKING SCREW (PRE MOD 25/2425) DO NOT REMOVE WHEN WINDOW IS INSTALLED
OUTER PERSPEX COMPONENT
INNER PERSPEX COMPONENT
0.05 IN MAX
CHEKALEKE PLUG (MOD 25/2425)
PERSPEX RING
RUBBER PACKING
EXTENT OF THIOKOL SEAL (ON WINDOW RECEIVING FRAME)
RETAINING BRACKET
DISTANCE PIECE
OUTER EDGE SEAL
0.02 IN
0.04 IN
PAN
FUSELAGE SKIN
V277/4
HA00B999445AA

SECTION A-A

Passenger compartment window installation
*Figure 201*

(10) Make sure that:

- (a) The outer face of window is within 0.040 in. into or out of wind.
- (b) If a repaired panel is installed (refer to Structural Repair Manual), the outer face of the window is within 0.070 in. out of wind or 0.040 in. into wind.
- (c) If the 6th window between frames 16/17, introduced by Mod.255661, is installed, the outer face of these windows is within 0.060 in. out of wind or 0.040 in. into wind.

(11) Remove the blanks, connect dry air system pipeline to the window connection and secure with five turns of copper wire or waxed No. 18 thread.

*NOTE: Do not remove the Pre-mod.252425 blanking screw in the inner panel or apply adhesive to the Chekaleke plugs (Mod.252425) in the inner panel.*

(12) Do a cabin leak rate check (Chapter 21, PRESSURIZATION CONTROL).

(13) Install the window trim panel.

(14) Examine the condition of the dry air system Silica gel crystals and renew as necessary (GENERAL).

## 2. Inspection/Check

### A. Inner and Outer Window Panels

For information on the extent of allowable damage to the passenger compartment windows, refer to the Structural Repair Manual 56-20-11.

## 3. Approved repairs

### A. Damage rectification

To avoid further deterioration which could lead to panel replacement, it is recommended that all damage, scoring, crazing, etc., should be rectified in accordance with the Structural Repair Manual as soon as possible.

### B. Rectification of seal

| Equipment/Material | Part/Item No. |
|---|---|
| Parting agent | 223 (Chapter 20-95-201) |
| White spirit (solvent) | 219 (Chapter 20-95-201) |
| Sealant | 313 (Chapter 20-95-301) |
| Wire brush | Local supply |

(1) Clean the surface of the seal thoroughly with cleaning agent (Item 219) and roughen with a wire brush.

(2) Apply sealant (Item 313) to the surface sufficient to make good the discrepancies in the seating (refer to Chapter 20, SEALING OF PRESSURE CABINS).

(3) Coat the mating face of the window panel and the outer edge seal with parting agent (Item 223), secure the window in the correct position until sealant has cured.

(4) Trim off any surplus sealant.

# CHAPTER
# 57
# WINGS

# CHAPTER 57

# WINGS

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57-00 WINGS DESCRIPTION

57-20 Wing to fuselage fairing seal.

* * *

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| * 201 | Aug.92(H) | | | | |
| * 202 | Aug.92(H) | | | | |

*** Indicates pages revised, added or deleted by the current revision.**

## WINGS - DESCRIPTION

The main wing structure consists of a box section formed by the front, centre and rear spars, and the top and bottom skins which are stiffened by Redux-bonded stringers. The left and right wings are joined together to form an integral wing unit.

Each wing box section forms an integral fuel tank. Sealants are used between faying surfaces of the spars, ribs and stringers to prevent leakage. Sealed access panels and manhole covers are provided to permit access during maintenance operations.

Bolted to the front spar is a two piece leading edge assembly which contains the landing lamps, leading edge spoilers, and fluid de-icing distributors.

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CAUTION : REMOVAL AND INSTALLATION OF WING LEADING EDGE AND/OR LEADING EDGE SPOILER CONSTITUTES A STRUCTURAL REPAIR WHICH INCLUDES CRITICAL ADJUSTMENT. FOR FULL INFORMATION REFER TO THE STRUCTURAL REPAIR MANUAL.

* * *

## WING-TO-FUSELAGE FAIRING SEAL - MAINTENANCE PRACTICES

### 1. Removal/Installation (Fig.201)

Materials required :-

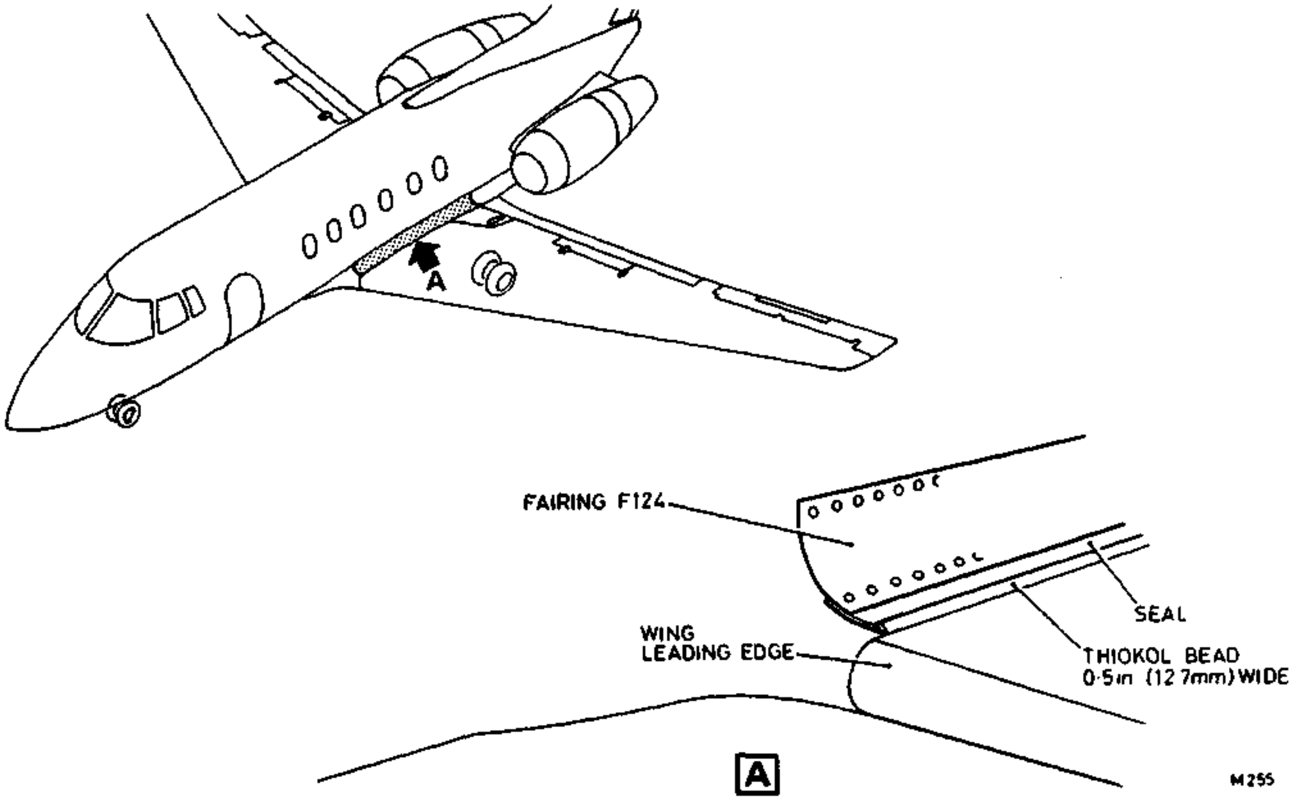
Bostik 2402 (Boscoprene cement)(Ref.20-10-4012) or
3M EC1300L (adhesive)(Ref.20-10-312)
Thiokol (brushing sealant) PR1422-B-2
Genklene or Methyl Ethyl Ketone (MEK)

WARNING : BE CAREFUL WHEN YOU USE METHYL ETHYL KETONE (MEK) :
- PUT ON SAFETY GOGGLES AND PROTECTIVE CLOTHING
- DO NOT BREATHE THE GAS (OR DUST)
- DO THE WORK IN AN AREA WHICH HAS A GOOD FLOW OF AIR.

IF YOU GET METHYL ETHYL KETONE (MEK) IN YOUR EYES OR ON YOUR SKIN :
- FLUSH YOUR EYES OR SKIN WITH WATER FOR AT LEAST 15 MINUTES
- GET MEDICAL HELP.

IF YOU ACCIDENTALLY DRINK OR EAT METHYL ETHYL KETONE (MEK) :
- DRINK WATER AND MAKE YOURSELF VOMIT
- GET MEDICAL HELP.

METHYL ETHYL KETONE (MEK) IS POISONOUS AND HIGHLY FLAMMABLE.



Installation of wing-to-fuselage fairing seal
Fig.201

A. Removal of damaged fairing seal (LH or RH)

(1) Release the bolts and remove the wing-to-fuselage fairing.

(2) Remove and discard the damaged fairing.

(3) Using clean cloths moistened with Genklene or MEK, remove all traces of old adhesive and Thiokol from the wing surface; where necessary, use a plastic or wooden spatula to dislodge stubborn material.

(4) Restore any damage to the wing paint finish.

B. Install fairing seal

(1) Remove all traces of French chalk/release agent from the replacement seal, then prepare the seal to receive the fairing attachment bolts.

(2) To provide a good key for the adhesive, lightly abrade the wing contacting surface of the seal using a wire brush.

(3) Thoroughly degrease the seal using clean cloths moistened with Genklene or MEK.

(4) Assemble the fairing and seal to the aircraft, attaching the seal to the wing surface using Bostik 2402 adhesive as detailed in Chapter 20-10-4012 or 3M EC1300L adhesive as detailed in Chapter 20-10-312.

(5) Edge the length of the seal with a ½ in.dia.bead of Thiokol as detailed in Chapter 20-10-1002, ensuring that half the bead width is in contact with the seal top surface.

(6) Check and restore any damage to the paint finish.

*   *   *

**Raytheon** Aircraft

# DH 125 Series 400A

(Mod.252550)

# Aircraft Maintenance Manual

# Volume 3

# Chapter 70 thru Chapter 80

CAUTION: Do not remove pages from this book unless instructed to do so, by an Authorized Letter of Transmittal.

The data contained in this manual is applicable to DH 125-400A (With Mod.252550) Series Airplanes only

NOTE: In the USA the 125 is known as the DH 125 (for Airplanes prior to NA 753) or the BH 125 ( for Airplanes NA 753 and subsequent).
These different identities have no effect on the contents of this manual.

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**P/N: MM 125 - F400AGV3**
**Issued: January 1978**

**Rev: 21**
**Dated: June 2003**

Published By
**RAYTHEON AIRCRAFT COMPANY**
P.O. Box 85
Wichita, Kansas 67201
U.S.A.

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ECCN: 9E991
NLR

Raytheon

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Company

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Manufacturers Association

# RECORD OF REVISIONS

| MFG REV NO | DESCRIPTION | ISSUE DATE | ATP REV DATE | INSERTED BY |
|---|---|---|---|---|
| 20 | See Highlights | 10/99 | 1/20/00 | ATP/KS |
| 21 | See Highlights | 6/03 | 8/28/03 | ATP/JB |
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# RECORD OF REVISIONS (NORMAL)

Revisions embodied in this manual, which have been issued by an approval authorization other than Raytheon Aircraft Company, must be recorded on separate record sheets.

| REV NO. | REVISION DATE | INSERTION DATE | BY |
|---|---|---|---|
| 1 | **NOTE: Revisions No. 1 to 19 inclusive were issued by Design Authorities *other than Raytheon Aircraft* Company. Refer to previous Record of Revisions sheet and Letters of Transmittal for details.** | | |
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# RECORD OF TEMPORARY REVISIONS

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# RECORD OF TEMPORARY REVISIONS

Revisions embodied in this manual, which have been issued by an approval authorization other than Raytheon Aircraft Company, must be recorded on separate record sheets.

| LOT NO. | Temporary Revision No. | Affecting | | Inserted | | Removed | |
|---|---|---|---|---|---|---|---|
| | | Part | Page | By | Date | By Revision No. | Date |
| 1 | | *NOTE:* **Temporary revisions No. 1 to 2 inclusive were issued by Design Authorities other than Raytheon Aircraft Company. Refer to previous Record of Revisions sheet and Letters of Transmittal for details.** | | | | | |
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125 AIRCRAFT MAINTENANCE MANUAL

Raytheon Aircraft Company
P.O. Box 85
Wichita
Kansas 67201
USA

DH 125 SERIES 400A (WITH MOD.252550)

(P/N: MM 125-F400AGV3)

# LETTER OF TRANSMITTAL - REVISION 21

## 1. HOLDERS OF PRINTED MANUALS

(1) Make sure that Revision 20 has been incorporated.

(2) Remove and destroy Temporary Revisions detailed for removal in paragraph 4 of this transmittal and cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of Volume 1.

(3) Insert the revision pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages as instructed in paragraph 3 of this transmittal.

(4) Record the incorporation of this revision on the new RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(5) Keep this Letter of Transmittal and file at the front of Volume 3.

## 2. HIGHLIGHTS

*NOTE: All topics/pages included in this revision have been re-issued and dated Jun.03.*

| Ch-Se-Su | Description of change |
|---|---|
| Title Page Volume 3 | Revised. Transfer of Type Certificate statement deleted and Export statement reworded. |
| LOEP LIST | Revised. |

## 3. INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| Title Page Volume 1 | 1/2 | 1/2 | - |
| LOEP List | 1 | 1 | - |

## 4. TEMPORARY REVISION DATA

No Temporary Revisions have been issued at this time.

**Raytheon** Aircraft

125 AIRCRAFT MAINTENANCE MANUAL

Raytheon Aircraft Company
PO Box 85,
Wichita,
Kansas 67201,
U.S.A.

BAe 125 Series 400A (Mod.252550) and F400B Aircraft

Manual Ref. MM125-F400AGV3

# LETTER OF TRANSMITTAL - REVISION 20

As part of the continuing manual improvement program the publishing method for the 125 Series F400AG V3 AMM is being updated. This results in a new format and appearance which could have the effect of reducing the number of pages.

This revision transmittal consists of a complete re-issue of the manual (from chapter 70 thru chapter 80) to introduce a new publishing format.

Only technical changes will be indicated by a revision bar in the left margin as usual.

## 1. HOLDERS OF PRINTED MANUALS

(1) Remove and discard the chapters 70 thru 80 of the Maintenance Manual and replace with this revision.

(2) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(3) Retain this Letter of Transmittal and file at the front of the manual.

## 2. SPECIAL INSTRUCTIONS

(1) On the existing Record of Revisions (Normal) sheet page 1, draw a diagonal line from Rev No. 20 to the bottom of the table. On page 2 draw further diagonal lines from Rev No. 37 and 61 to the bottom of each table. On the two pages write in bold lettering "DO NOT USE THIS SHEET FOR RECORDING THE INCORPORATION OF ANY FUTURE REVISIONS, USE THE NEW SHEET ISSUED BY RAYTHEON AIRCRAFT COMPANY".

(2) On the existing Record of Temporary Revisions sheet page 1, draw a diagonal line from LOT No.3 to the bottom of the page. On this page write in bold lettering "DO NOT USE THIS SHEET FOR RECORDING THE INCORPORATION OF ANY FUTURE TEMPORARY REVISIONS, USE THE NEW SHEET ISSUED BY RAYTHEON AIRCRAFT COMPANY".

NOTE: *Do not discard the existing Record of Revisions and Record of Temporary Revisions Sheets, they MUST be retained for reference.*

## 3. HOLDERS OF MICROFILM OR MICROFICHE

(1) Discard the existing maintenance manual microfilm or microfiche and replace with a new copy at Revision 20 standard.

Raytheon Corporate Jets, Inc.,
3 Bishop Square,
St. Albans Road West,
Hatfield, Hertfordshire,
AL10 9NE, England.

This permanent revision/amendment complies with British Civil Airworthiness Requirements, Section A, Chapter A5-3.

Signed ............................................................................Date 9.6.95..........................................................

CAA Approval No: DAI/2652/55

To holders of: BAe 125 Series 400A (Mod.252550) and F400B Aircraft

(Reference MM125-F400AGV3)

# LETTER OF TRANSMITTAL - REVISION 19

## 1. HOLDERS OF PRINTED MANUALS

(1) Check that Revision 18 has been incorporated.

(2) Remove and discard Change of Address/Registration card and insert new card issued with this revision.

(3) Remove and destroy any pages detailed for removal on page 3 of this transmittal and cancel any entries for the temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the manual.

(4) Remove and destroy the existing pages replaced by the revised pages.

(5) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(6) Retain this Letter of Transmittal and file at the front of Volume 3.

## 2. HOLDERS OF MICROFILM OR MICROFICHE

(1) Remove and destroy pages from the TEMPORARY REVISIONS AND AVIONIC FIT DATA BINDER as detailed for removal on page 3 of this transmittal. Cancel any entries for these temporary revisions on the RECORD OF TEMPORARY REVISIONS sheet at the front of the binder.

## 3. HIGHLIGHTS

| Ch-Se-Su | Description of change |
|---|---|
| **CHAPTER 71:** | |
| LOEP | Revised and reformatted.<br>71-00-00 page 507 - date corrected.<br>71-00-00 pages 547 and 548 now included.<br>71-10-00 pages 403 and 404 - dates corrected. |
| **CHAPTER 76:** | |
| LOEP | Revised and reformatted |
| CONTENTS | Contents reformatted.<br>76-10-01, page block 601 added. |
| 76-10-01 | Pages 601 and 602 added. |

## 4. INSTRUCTIONS FOR INCORPORATING THIS REVISION

| Ch-Se-Su | Remove Page | Insert Page | Remove TR |
|---|---|---|---|
| 71-LOEP | 1 | 1 | |
| 71-LOEP | 2 | 2 | |
| 71-LOEP | - | 3 | |
| 76-LOEP | 1 | 1 | |
| 76-CONTENTS | 1 | 1 | |
| 76-10-01 | - | 601 | |
| 76-10-01 | - | 602 | |

## 5. TEMPORARY REVISION DATA

Record the removal of the following Temporary Revisions.

None.

RAYTHEON CORPORATE JETS
BAe 125 AIRCRAFT MAINTENANCE MANUAL

BAe 125 Series 400A (Mod.252550) and F400B Aircraft

Reference MM125-F400AGV3)

# LETTER OF TRANSMITTAL
# FOR REVISION No.18

Issued by
Raytheon Corporate Jets
3, Bishop Square,
St. Albans Road West,
Hatfield, Hertfordshire,
AL10 9NE, England.

This permanent/amendment complies with British Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed ................................ Date ..21st February 1994..........
CAA Approval No.DAI/2652/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

### HOLDERS OF PRINTED MANUALS

(1) Check that Revision 17 has been incorporated.

(2) Insert the revised page, remove and destroy the existing page replaced by the revised page.

(4) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 1.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

TITLE PAGE Vol.3 Title page revised to Raytheon Corporate Jets standard.

# BRITISH AEROSPACE
# BAe 125 SERIES AIRCRAFT MAINTENANCE MANUAL (VOL.3)

BAe 125 Series 400A (Mod.252550) and F400B aircraft

(Manual Ref.MM125-F400AGV3)

## LETTER OF TRANSMITTAL
## FOR REVISION No.17

Issued by
Corporate Jets Limited
St. Albans Road West, Hatfield
Hertfordshire, AL10 9NE,
England

This permanent revision complies with British Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed.......................... Date.26.02.93......
CAA Approval No. DAI/2652/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

### 1. HOLDERS OF PRINTED MANUALS

A. Check that revision 16 has been incorporated.

B. Remove and destroy the following pages :
TR71-2 and cancel the entry in the RECORD OF TEMPORARY REVISIONS.

C. Insert the pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages.

D. Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

E. Retain this Letter of Transmittal.

## HIGHLIGHTS

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|---|---|---|
| TITLE PAGE: | V3 | Page revised and updated. |
| CHAPTER 71: | LOEP | Pages revised to show the current revision. |
| | 71-00-00 | TR71-2 incorporated. Note added for capping of engine bleed ports, LMM report number changed. |
| CHAPTER: 76 | LOEP | Page revised to show the current revision. |
| | 76-10-01 | Note added for control cable maintenance. |

# BRITISH AEROSPACE
# BAe 125 SERIES AIRCRAFT MAINTENANCE MANUAL (VOL.3)

BAe 125 Series 400A(Mod.252550) and F400B Aircraft
(Manual Ref.MM125-F400AGV3)

## LETTER OF TRANSMITTAL

## FOR REVISION No.16

Issued by
British Aerospace
(Commercial Aircraft) Limited
Airlines Division
Hatfield, Hertfordshire, England

This permanent revision complies with British Civil Airworthiness Requirements Section A, Chapter A5-3.

Signed......................... Date.17.5.91..........
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision 15 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by the revised pages.

(3) Record the incorporation of this Revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

| | |
|---|---|
| 73-Contents | Garrett report No. changed. |
| 73-00-00 | Garrett report No. changed. |
| 73-20-11 | Garrett report No. changed. |
| 73-31-11 | Garrett report No. changed. |
| 73-32-11 | Garrett report No. changed. |
| 73-33-11 | Garrett report No. changed. |
| 73-34-11 | Garrett report No. changed. |

* * *

BRITISH AEROSPACE
HS 125 MAINTENANCE MANUAL (VOL.3)

DH 125 Series 400A (with Mod.252550) AIRCRAFT
HS 125 Series F400B AIRCRAFT

(Reference MM125-F400AGV3)

# LETTER OF TRANSMITTAL FOR REVISION No.15

Issued by
British Aerospace
(Commercial Aircraft) Limited
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed ................................ Date 10th May 1989
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.14 has been incorporated.

(2) Remove and destroy the following pages :-
TR 71-1, cancel entry in RECORD OF TEMPORARY REVISIONS.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 71 : Engine ground running procedures revised.

CHAPTER 80 : Minor contents page changes.

# HS 125 MAINTENANCE MANUAL (VOL.3)
# DH 125 Series 400A (with Mod.252550) AIRCRAFT
# HS 125 Series F400B AIRCRAFT

(Reference MM125-F400AGV3)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.14

Issued by
British Aerospace Public Limited Company,
Aircraft Group, Hatfield-Chester Division,
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .............................. Date ......31st August, 1983..........
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.13 has been incorporated.

(2) Remove and destroy the following pages :-
71-00-00 pages B401 - B442
C401 - C456

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

**CHAPTER 71** : Engine conversion instructions deleted.
Engine removal/installation procedures rationalized.
Power plant lubricants revised.

**CHAPTER 77** : Engine indicating descriptive information updated.

* * *

# HS 125 MAINTENANCE MANUAL (VOL.3)
# DH 125 Series 400A (with Mod.252550) AIRCRAFT
# HS 125 SERIES F400B AIRCRAFT

(Reference MM125-F400AGV3)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.13

Issued by
British Aerospace Public Limited Company,
Aircraft Group, Hatfield-Chester Division,
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .............................. Date 15th September 1982
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.12 has been incorporated.

(2) Remove and destroy the following pages :-
71-00-00 pages 547-548
80-00-02 complete subject.

(3) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(4) Record the incorporation of this revision on the RECORD OF REVISIIONS (NORMAL) sheet at the front of Volume 3.

(5) Retain this Letter of Transmittal.

## HIGHLIGHTS

General : Editorial changes.
Garrett 731 Maintenance Manual Report No.72-00-82 revised to read 72-00-75 in all chapters of this manual.

CHAPTER 71 : Take-off reference N1% charts deleted and graph substituted.

CHAPTER 80 : Deletion of non-applicable data.

* * *

# HS 125 MAINTENANCE MANUAL (VOL.3)
# DH 125 Series 400A (with Mod.252550) AIRCRAFT
# HS 125 Series F400B AIRCRAFT

(Reference MM125-F400AGV3)

## LETTER OF TRANSMITTAL
## FOR
## REVISION No.12

Issued by
British Aerospace Public Limited Company,
Aircraft Group, Hatfield-Chester Division,
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .................................. Date 30th March 1982
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.11 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

**CHAPTER 71** : Engine starting check list - hydraulic pressure revised.
Power plant Adjustment/Test - hydraulic pressure revised.

**CHAPTER 73** : Garrett 731 Maintenance Manual report No.72-00-82 revised to read 72-00-75 (this change applies to all similar entries in this manual).

Engine synchronizer and APR controller Maintenance Practices revised to incorporate bonding details introduced by Mod.252735.

System signal conditioner Maintenance Practices added.

...Letter of Transmittal for Revision No.12 continued

## HIGHLIGHTS continued

**CHAPTER 77** : Interstage turbine temperature lead shortening procedure revised to correct magnetic identification of Chromel and Alumel conductors.

**CHAPTER 80** : Mod.252780 incorporated - to prevent main engine generators supporting the APU starting circuit.

* * *

HS 125 MAINTENANCE MANUAL (VOL.3)
DH 125 Series 400A (With Mod.252550) AIRCRAFT
HS 125 Series F400B AIRCRAFT

(Reference MM125-F400AGV3)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.11

Issued by
British Aerospace Public Limited Company,
Aircraft Group, Hatfield-Chester Division,
Hatfield, Hertfordshire, England.

This permanent revision complies with British Civil Airworthiness Requirements, Section A, Chapter A6-2.

Signed .............................. Date 30th September 1981
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.10 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

(4) Retain this Letter of Transmittal.

## HIGHLIGHTS

CHAPTER 71: Neverseez compound called up for lubrication of engine rear attachment bolt.

Engine installation and cowling removal/installation procedures revised to cover checks required on starter generator cables to pre Mod.252779 standard. (Mod.252779 introduces revised cable arrangements in engine pods and this revision aligns with the starter generator Maintenance Practices in Chapter 24).

CHAPTER 77: Interstage turbine temperature (ITT) indication circuit details, table 503, revised to correct panel identification.

* * *

125 MAINTENANCE MANUAL (VOL.3)
DH 125 Series 400A (With Mod.252550) AIRCRAFT
HS 125 Series F400B AIRCRAFT

(Reference MM125-F400AGV3)

# LETTER OF TRANSMITTAL
# FOR
# REVISION No.10

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Signed ........................................ Date 31st December, 1980.............
CAA Approval No. DAI/1011/55

## INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.9 has been incorporated.

(2) Insert the pages in numerical sequence, removing and destroying the existing pages replaced by revised pages.

(3) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

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## HIGHLIGHTS

CHAPTER 73: Maintenance Practices for APR controller, APR event counter and APR throttle - actuated microswitch now referenced Pre Mod.252719.

* * *

125
MAINTENANCE MANUAL

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# DH 125 Series 400A (With Mod.252550) AIRCRAFT
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### INSTRUCTIONS FOR INCORPORATING THIS REVISION

(1) Check that Revision No.7 has been incorporated.

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(3) Remove and destroy the following pages :-

77-21-0 pages 201-206

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### HIGHLIGHTS

CHAPTER 71 : Correction to fuel system low pressure warning switch setting. 6 to 7 lb/sq.in. was 3 ± 0.5 lb/sq.in.

Mod.252719 (deletion of APR event counter) incorporated.

CHAPTER 73 : Electronic computer removal/installation procedure expanded. APR data revised to incorporate Mod.252719 (deletion of APR event counter and throttle power lever microswitch).

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...Letter of Transmittal for Revision 9 continued

HIGHLIGHTS continued

CHAPTER 76 : Rigging procedure for control cable system and Teleflex control system in pylon revised.
Control system check/adjust procedure and functional check data added.

CHAPTER 77 : Interstage turbine temperature indication Maintenance Practices subject corrected to read Adjustment/Test and renumbered to page 501 block.

* * *

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NOTE : The above instruction is applicable to 'A' Series aircraft publications only. 'B' Series aircraft publications already have revised spine card and title page.

(5) Record the incorporation of this revision on the RECORD OF REVISIONS (NORMAL) sheet at the front of Volume 3.

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## HIGHLIGHTS

CHAPTER 71 : General update of chapter.
Instructions given for conversion of model TFE 731-3-1F engine to BAe 125 standard configuration.
Procedure given for removal of engine or power plant for subsequent reinstallation.
Starting, stopping and motoring data added.

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...Letter of Transmittal for Revision No.7 continued

HIGHLIGHTS continued

CHAPTER 72 : 72-00-00 Sub-assemblies and components - removal/installation data added.

CHAPTER 73 : 73-00-00 Sub-assemblies and components - removal/installation data added.

CHAPTER 74 : 74-00-00 Sub-assemblies and components - removal/installation data added.

CHAPTER 75 : Mod.252718 (introduction of fan conical spinner) incorporated, and procedure given to delete/restore spinner anti-icing to suit pre and post Mod. configurations.

CHAPTER 76 : Sub-assemblies and components - removal/installation data added.
Throttle lever alignment procedure added.

CHAPTER 77 : Servicing data issued.
Sub-assemblies and components - removal/installation data added.

CHAPTER 79 : Sub-assemblies and components - removal/installation data added.

* * *

125 MAINTENANCE MANUAL

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## HIGHLIGHTS

CHAPTER 71 : Page 551 of 71-00-00 re-issued(chapter details omitted on Revision 5).

CHAPTER 80 : Corrections following initial issue of Chapter.

* * *

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## SERIES 400A (with Mod.252550) AIRCRAFT

(Reference MM125-F400AGV3)

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### HIGHLIGHTS

General update of Chapters 71,72,73,74,76,77 and 79 and revision to APR data.

* * *

## CURRENT LOEP DATES AT REVISION No. 21

| CHAPTER | DATE LAST REVISED |
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# CHAPTER

# 70

# STANDARD PRACTICES (ENGINES)

# CHAPTER 70

# STANDARD PRACTICES - ENGINE

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STANDARD DISASSEMBLY PROCEDURES

STANDARD REASSEMBLY PROCEDURES

REPLACEABLE COMPONENTS

COMPONENT HANDLING

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# CHAPTER 71

# POWER PLANT

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# POWER PLANT
# DESCRIPTION AND OPERATION

## 1. General description *(Figure 1 and Figure 2)*

The aircraft is propelled by two Garrett AiResearch Model TFE 731-3-1H turbo-fan engines installed in pods mounted on pylons, one on each side of, and integral with the rear fuselage.

Firewalls divide each pod into two fire zones which are ventilated by ram air and both zones incorporate a fire/overheat warning system. The 'two-shot' fire extinguishing system discharges only into Zone 1, the forward zone.

Hot air is bled from the engine to pressurize and air condition the aircraft, to operate the rudder bias system, to pressurize the hydraulic system tank and for engine anti-icing.

Each engine has a combined starter/generator and can be started from either the aircrafts' batteries or a ground power supply. The right engine has an a.c. generator for pilots' windshield de-icing (Chapter 30, ICE AND RAIN PROTECTION - WINDSHIELD ELECTRICAL DE-ICING SYSTEM). Installation of an a.c. generator to the left engine is optional.

A combined power control/shut-off valve lever on each engine is controlled by separate throttle and high pressure cock levers on the pilots central control pedestal. Closure of the high-pressure cock lever automatically returns the throttle lever to its closed position, if it is open.

During normal operation, in response to the throttle lever movement each engines' performance is controlled by its electronic computer in the rear equipment bay. Manual control mode is available to cater for computer or electrical failure situations.

External details of the power plants are shown in *Figure 1 and Figure 2.*

## 2. Pylon *(Figure 3)*

The pylon has a firewall at the interface with the engine Zone 1. Forward and aft of this section the nacelle pod butts against the pylon sealing strip.

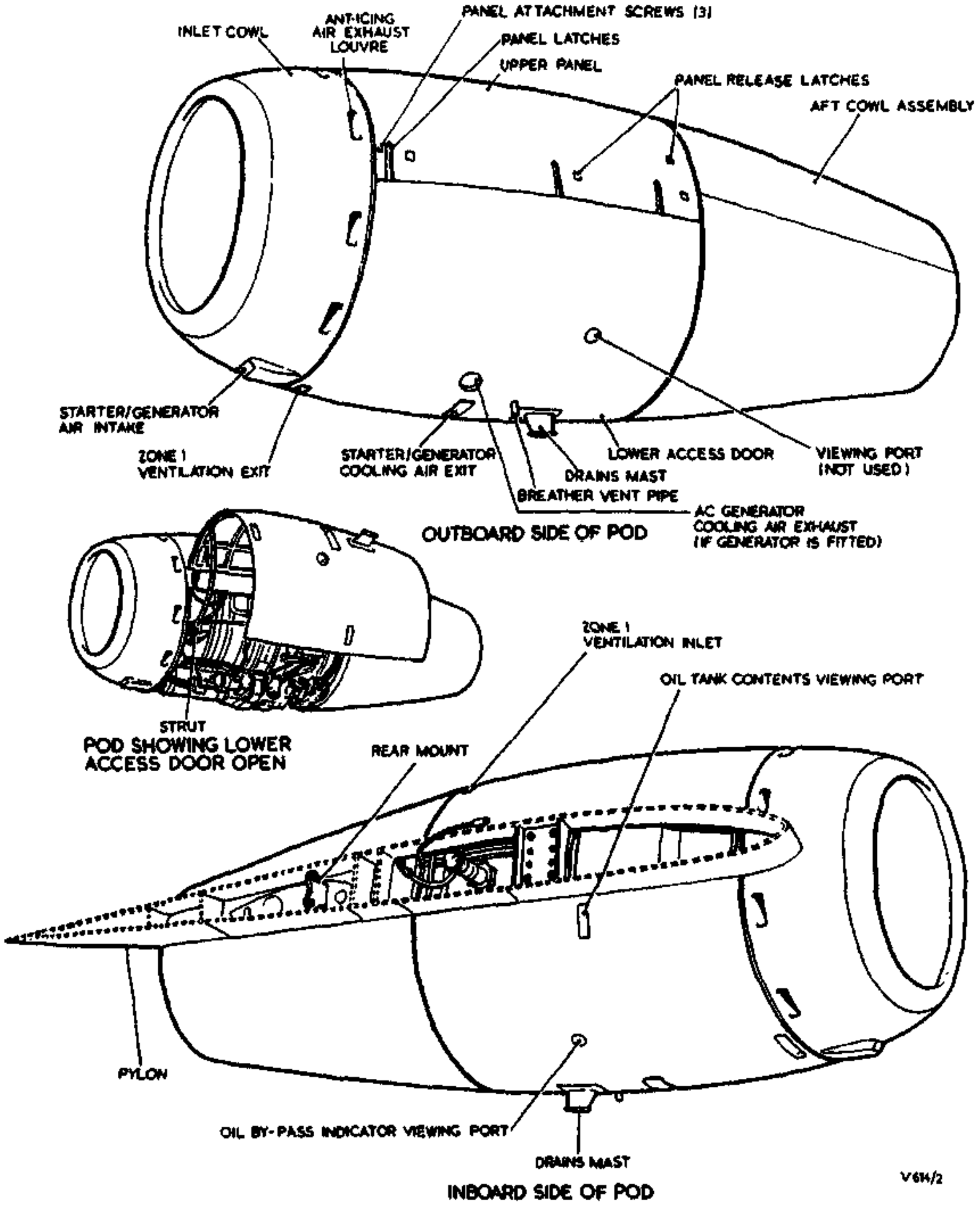
Quick-release panels on the pylon top and bottom skin give access to the engine rear mount bolts and system disconnect points. Each skin incorporates a pressure relief door.

## 3. Engine mounts

Front and rear mounts, which can be installed to either side of the engine, connect each engine to its respective pylon. The front mount will support the entire weight of the engine, allowing the rear mount to be removed to facilitate engine maintenance.

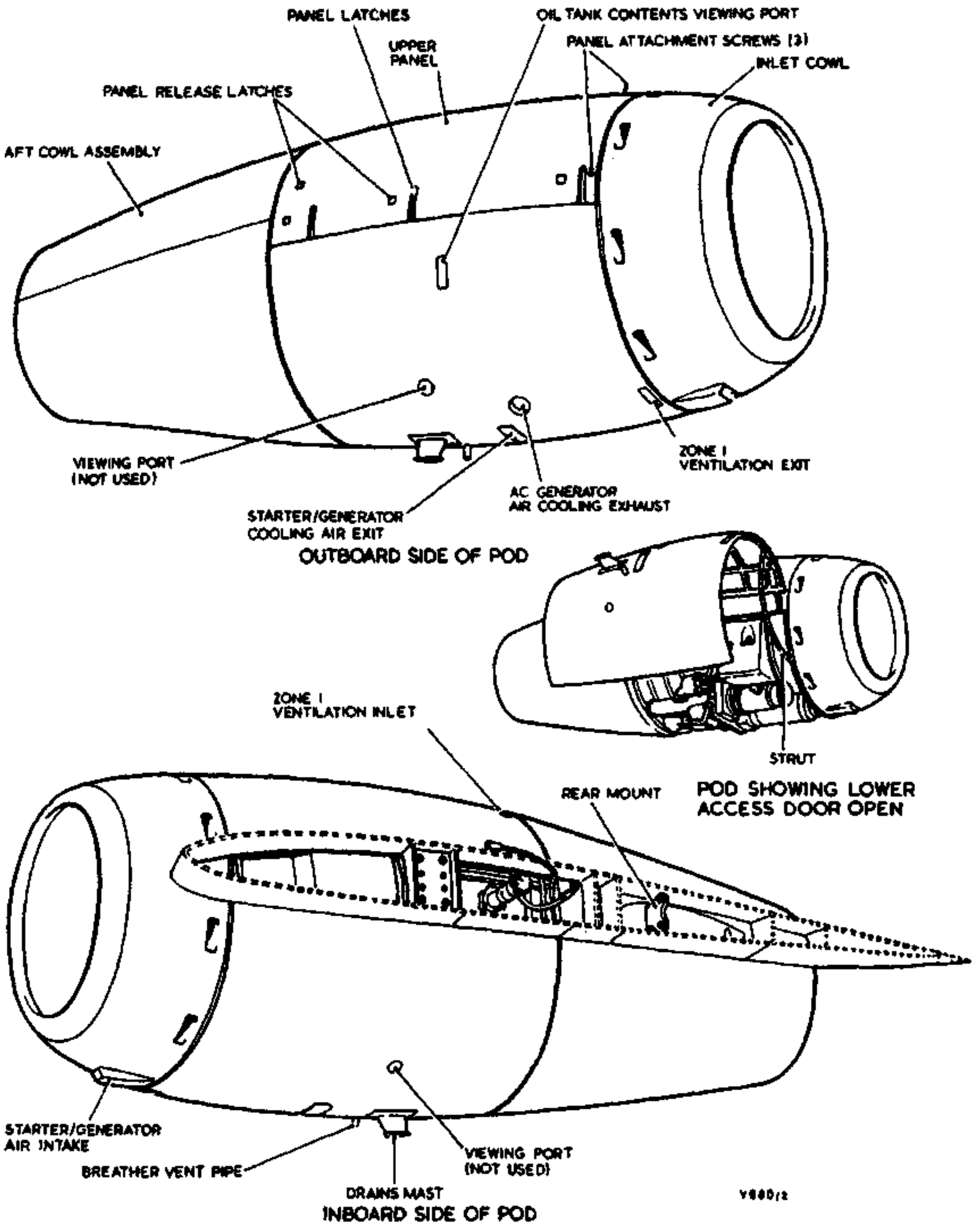
## 4. Nacelle

The nacelle comprises four cowls which are mounted entirely on the engine and can be removed completely, to expose the engine and all its systems. Routine servicing of the oil system and general engine maintenance may all be done by opening the lower access door.


INLET COWL
ANTI-ICING AIR EXHAUST LOUVRE
PANEL ATTACHMENT SCREWS (3)
PANEL LATCHES
UPPER PANEL
PANEL RELEASE LATCHES
AFT COWL ASSEMBLY
STARTER/GENERATOR AIR INTAKE
ZONE 1 VENTILATION EXIT
STARTER/GENERATOR COOLING AIR EXIT
LOWER ACCESS DOOR
DRAINS MAST
BREATHER VENT PIPE
VIEWING PORT (NOT USED)
AC GENERATOR COOLING AIR EXHAUST (IF GENERATOR IS FITTED)
OUTBOARD SIDE OF POD
STRUT
POD SHOWING LOWER ACCESS DOOR OPEN
ZONE 1 VENTILATION INLET
OIL TANK CONTENTS VIEWING PORT
REAR MOUNT
PYLON
OIL BY-PASS INDICATOR VIEWING PORT
DRAINS MAST
INBOARD SIDE OF POD
V614/2

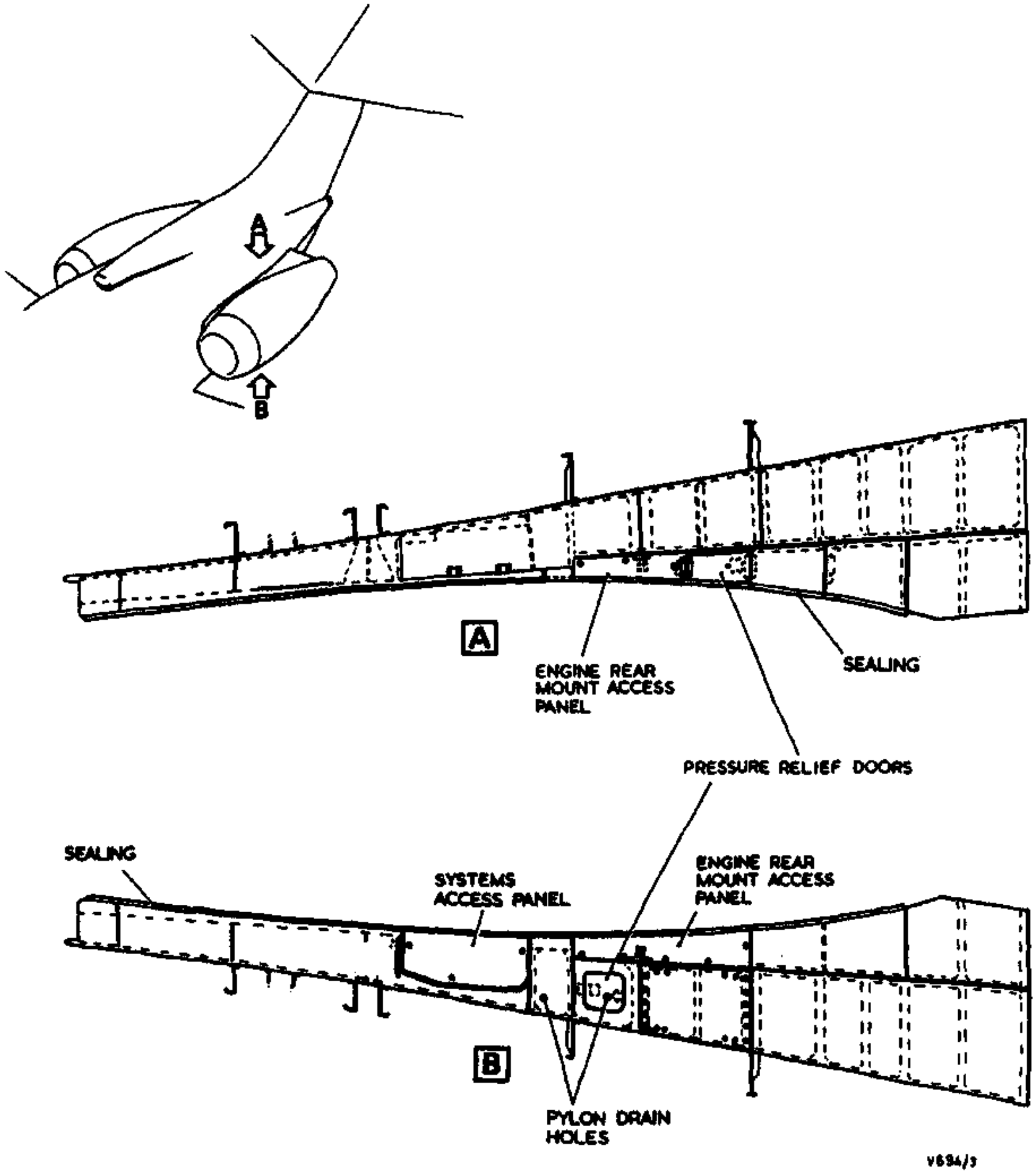
Power plant No.1 - external details

*Figure 1*



Power plant No.2 - external details

*Figure 2*



Pylon panel details
*Figure 3*

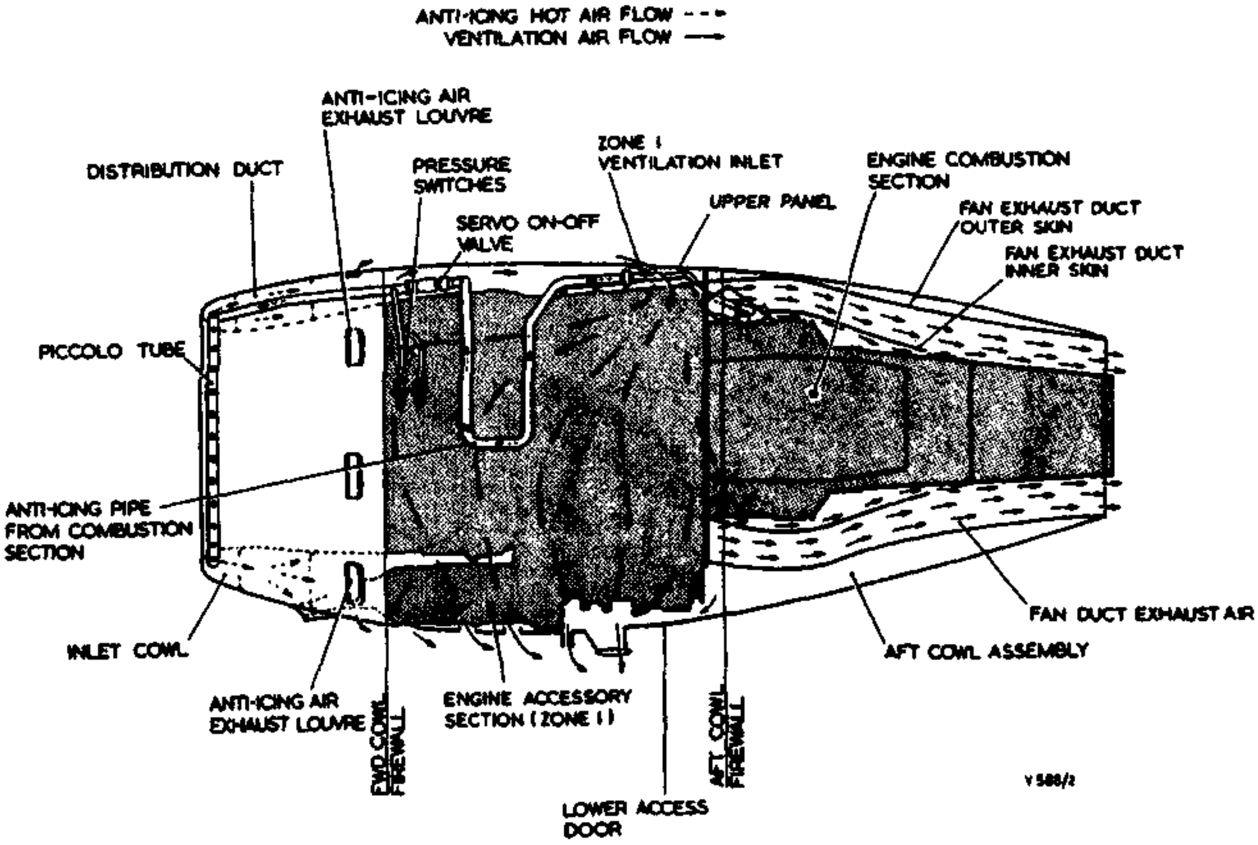
## 5. Engine anti-icing

Hot air is bled from each engines high pressure compressor to prevent the formation of ice on its fan spinner (Pre-Garrett AiResearch SB.72-3085 and Pre-Mod.252718) and nacelle air inlet cowl.

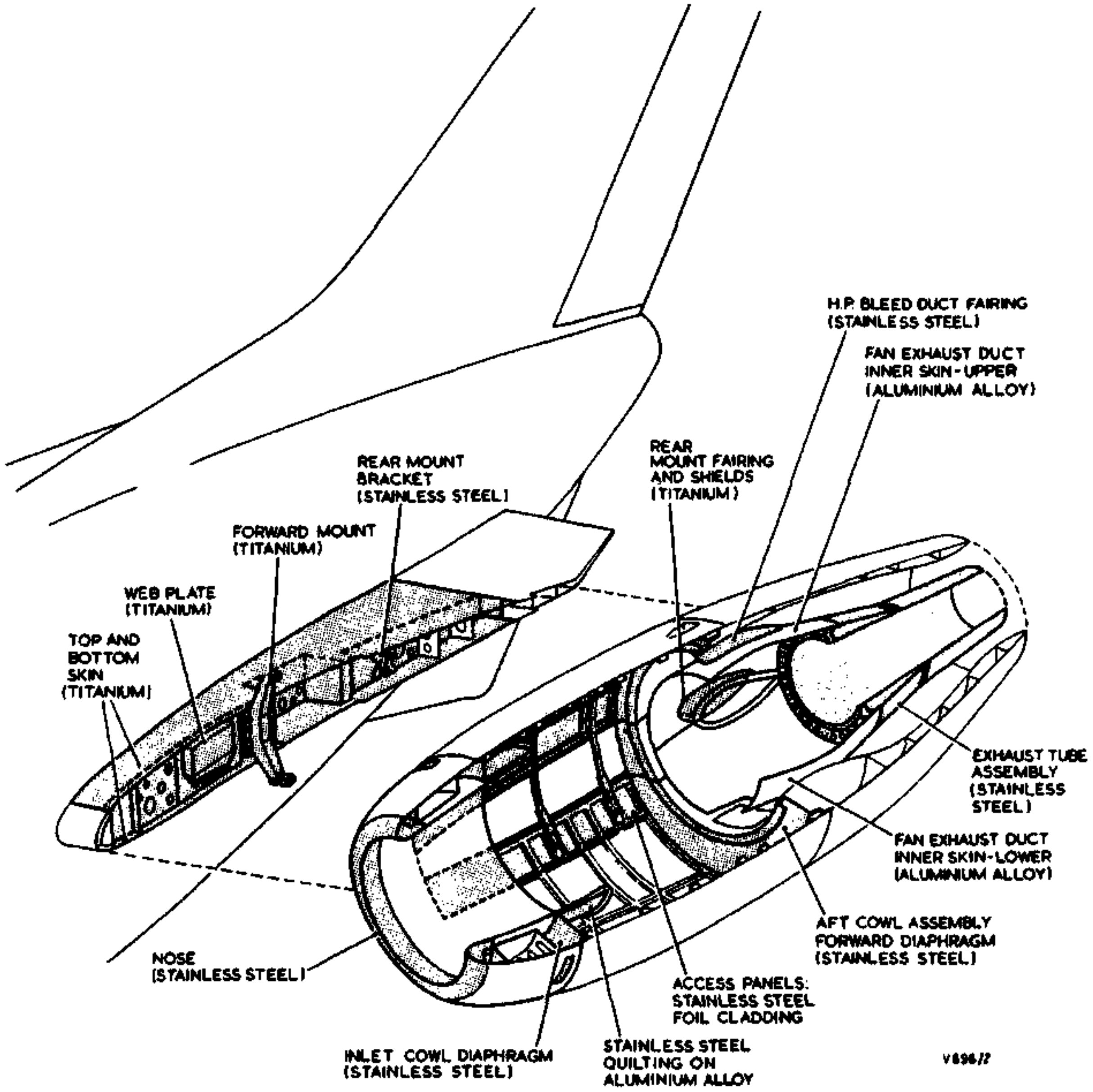
An integral electrical heating element is used to prevent ice formation on the inlet air pressure and temperature sensor, located forward of the engine fan blades. The outputs from this sensor are required by the electronic computer.

## 6. Throttle controls

The power control lever on each engine is connected by Teleflex control to a control linkage in the pylon. From this point the controls are linked to the throttle and high pressure cock control levers in the flight compartment by a cable control run.



Ventilation
*Figure 4*


H.P. BLEED DUCT FAIRING (STAINLESS STEEL)
FAN EXHAUST DUCT INNER SKIN-UPPER (ALUMINIUM ALLOY)
REAR MOUNT FAIRING AND SHIELDS (TITANIUM)
REAR MOUNT BRACKET (STAINLESS STEEL)
FORWARD MOUNT (TITANIUM)
WEB PLATE (TITANIUM)
TOP AND BOTTOM SKIN (TITANIUM)
EXHAUST TUBE ASSEMBLY (STAINLESS STEEL)
FAN EXHAUST DUCT INNER SKIN-LOWER (ALUMINIUM ALLOY)
AFT COWL ASSEMBLY FORWARD DIAPHRAGM (STAINLESS STEEL)
NOSE (STAINLESS STEEL)
ACCESS PANELS: STAINLESS STEEL FOIL CLADDING
INLET COWL DIAPHRAGM (STAINLESS STEEL)
STAINLESS STEEL QUILTING ON ALUMINIUM ALLOY
V896/2

Power plant firewalls
*Figure 5*

## 7. Fire protection and ventilation *(Figure 4 and Figure 5)*

The stainless steel interface frames of the nacelle inlet and the aft cowl assemblies and the inboard side of the upper panel and lower access doors, form the engine accessory section into a fire containment zone (zone 1). This zone is protected by the fire extinguishant system. Excessive heat is detected by heat sensors in both zone 1 and the combustor section (aft cowl assembly - zone 2) of the pod.

In flight, zone 1 is ventilated by ram air passing through an inlet scoop in the upper cowl panel and, after circulating around the engine accessory section, exhausts through a louvre and the drains mast in the lower access door. The inlet scoop also acts as a chimney for heat dissipation from the engine and HP air bleed system on engine shut-down.

Zone 1 ventilation air is drawn into an a.c. generator on the right engine by way of a flameproof wire mesh air intake clamped to the generator. Spent air from the generator exhausts overboard through a port in the lower access door. If installed, an a.c. generator on the left engine is similarly cooled.

Fire protection, ventilation and cooling, of the engine combustion section (zone 2), within the aft cowl assembly, is achieved by utilizing the fan exhaust air passing through an annular duct formed by a fan duct inner skin and a fan duct outer skin in the aft cowl assembly. The annular inner skin encloses the combustion section and holes in a forward position of the skin takes air from the fan exhaust duct, circulates it between the inner skin and combustion section, and exhausts it through slots in the rear edge back into the fan exhaust duct stream.

# POWER PLANT - REMOVAL/INSTALLATION ENGINE CHANGE

## 1. Remove engine

**CAUTION: KEEP AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF ENGINES: THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER COMPONENT IS REMOVED, IMMEDIATELY INSTALL A BLANK TO THE APERTURE.**

| Equipment/Material | Part/Item No. |
|---|---|
| Power plant sling | 25-7Y9-A |
| Power plant stand | 25-7Y-25A or equivalent |
| Torque wrench adapter | SPL3652 |
| Torque wrench | 100-110 lbf in. |
| Drip trays | Operator supplied |
| Drains container (approx 5 Imp.gal. capacity) | Operator supplied |

*NOTE: Special tools and equipment required during installation are listed in paragraph 2 - Install engine.*

### A. Prepare to remove engine

(1) General:

(a) The sequence of operations given are those required to disassemble a power plant down to basic engine standard with the unit still installed in an aircraft.

(b) If an engine is the subject of an unscheduled removal due to an unrectifiable defect, take a sample from the oil tank before any proposed inhibiting procedure. The oil sample may well enhance the subsequent defect investigation and should be returned with the engine.

*NOTE: Due to the complexity of the bolt-up arrangement at the engine rear mount fairing and the necessity for correct identity of bolts/ washers/nuts during the disassembly and reassembly stages of an engine change, it is recommended that an aide-memoire panel for storage of bolts etc. be locally manufactured. The panel can be made from thin metal or plywood using the layout given by Figure A408 Sheet 1& 2, suitably enlarged. Drill the holes using a 4.9 mm diameter drill and stencil LH on the obverse face and RH on the reverse face.*

(c) Before removing the two transferable engine electrical harnesses, the removal of harness retention P-clips is progressive and they together with their supporting angles, plates or brackets should be left attached to the harness wherever possible with the associated attachment bolts, washers, stiffnuts.

(2) Arrange for attendance of mobile hoisting gear or make sure aircraft is positioned beneath an overhead hoisting gantry.

*NOTE: Hoisting gear must have a 'Safe Working Load' capacity of not less than 1,200 lb.*

(3) Prepare an empty stand to receive the removed engine.

(4) Position and prepare the aircraft:

(a) Make sure lock pins 25-Y-33A and 25-Y-197A are installed to the nose and main landing gear units respectively.

(b) Apply brakes and chock wheels fore and aft.

*NOTE: If aircraft is on jacks, use wing steady trestles.*

(c) Make sure air intake blanks and exhaust covers are installed both before and after removal of cowlings.

(5) Hydraulic system tank air pressure:

(a) Unscrew the tank filler cap two turns only.

(b) Allow residual air pressure to disperse.

(6) Release hydraulic system main accumulator pressure:

(a) With a 28 volt d.c. ground power supply connected, operate the flaps or air brakes until the pressure indicator reading reduces to 2,700 psi.

(b) With the handbrake lever set fully forward exercise the footbrake pedals until, with the brakes fully ON, the associated indicators read zero.

(7) Release hydraulic system emergency brake accumulator pressure:

(a) Set the brake lever to the red sector and exercise the foot brake pedals until the accumulator pressure gauge reads between 950 and 1000 psi.

(8) Make sure that the appropriate LP and HP fuel cock levers are set at OFF. Fix a notice to the levers forbidding interference.

(9) Uncowl the power plant:

(a) At the inboard latches on the lower access door insert a short screwdriver (approximately three inches long) into each facia slot in turn and lever outward to release. Open the access door.

(b) With the lower access door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into the facia hole and lever outward to release. Remove the access door.

(c) At the aft edge of the upper panel, insert a suitable 0.25 in. diameter rod into the facia hole of each shear pin latch in turn and lever outward to release.

(d) At the forward edge of the upper panel, remove the three countersunk bolts securing the panel to the inlet cowl. Carefully remove the upper panel making sure that its hinge bars (3 off) do not damage local electrical cables or looms.

(10) Isolate electrical power supplies by removing circuit fuses and opening circuit breakers (Table A401).

(11) Remove the access panels from the pylon top and bottom surfaces at the engine front and rear mounts and the systems access panel.

(12) Place drip trays beneath the engine.

B. **Disconnect electrical services** *(Figures A401, A402 and A403)*

**CAUTION: AFTER DISCONNECTING CABLES MAKE SURE THAT THEY ARE EASILY IDENTIFIABLE: IF NECESSARY, INSTALL IDENT TAGS TO FACILITATE SUBSEQUENT CORRECT RECONNECTION.**

(1) Disconnect the N1 monopole and ITT harness at the power plant/pylon interface:

(a) Remove the four bolts securing the terminal cover and remove the cover.

(b) Loosen locknuts, disconnect N1 monopole connector plug, coded TV1 (left) or TW1 (right).

(c) Loosen locknuts, disconnect ITT computer connector plug, coded TV2 (left) or TW2 (right).

(d) Pre-Mod 252657 only. Remove fairleads and tie up locally at the pylon.

(e) Disconnect the two ITT indicator leads from terminal block, coded LY (left) or MY (right) and Mod.252657 pull the indicator leads through the mounting bracket.

(2) Disconnect the three electrical connectors, TA1, TA2 and TA3, (left) or TB1, TB2 or TB3 (right) at the pylon/power plant interface.

(3) Release the starter/generator heavy and light duty cables from the generator:

(a) Slide back the starter/generator terminals protective boot.

(b) Remove the nuts and washers or screws. Disconnect the heavy and light duty cables from the starter/generator.

(4) Left engine disconnections:

(a) Unclip cables from fuel and hydraulic pipes back as far as the fuel filter.

(b) Uncleat cables back to the pylon.

(c) Disconnect speed sensor connector from the starter/generator.

(d) Secure cables clear of the power plant.

(5) Right engine disconnections:

  (a) Unclip cables back as far as the oil pipe.

  (b) Uncleat cables back to the pylon.

  (c) Disconnect speed sensor connector from the starter/generator.

  (d) Secure cables clear of the power plant.

(6) Disconnect a.c. generator electrical cables - right engine or left engine (if installed):

  (a) Disconnect the electrical plug from the a.c. generator.

  (b) Unclip cables back to the pylon.

  (c) Secure the cables clear of the power plant.

### C. Disconnection of mechanical services and components *(Figures A401, A402, A403, A404)*

(1) Release the V-clamp bolt of the engine high-pressure air bleed duct at the pylon disconnect coupling. Remove the clamp.

(2) Disconnect the rudder bias system pipe at the pylon disconnect point.

(3) Release the engine low-pressure air bleed pylon connector clamp bolt. Remove the V-clamp.

(4) Disconnect the throttle/high pressure fuel cock Teleflex control brackets, disconnect Teleflex control unit from fuel control unit and secure clear of the power plant. Retain Teleflex control unit attachment bolts.

(5) Disconnect the PT2 pipe at the pylon disconnect junction. Blank off each open end of the system.

(6) Disconnect witness drain pipes:

  (a) Accessories drive at hydraulic pump.

  (b) Accessories drive at starter/generator.

  (c) Accessories drive at a.c. generator.

  (d) Fuel pump.

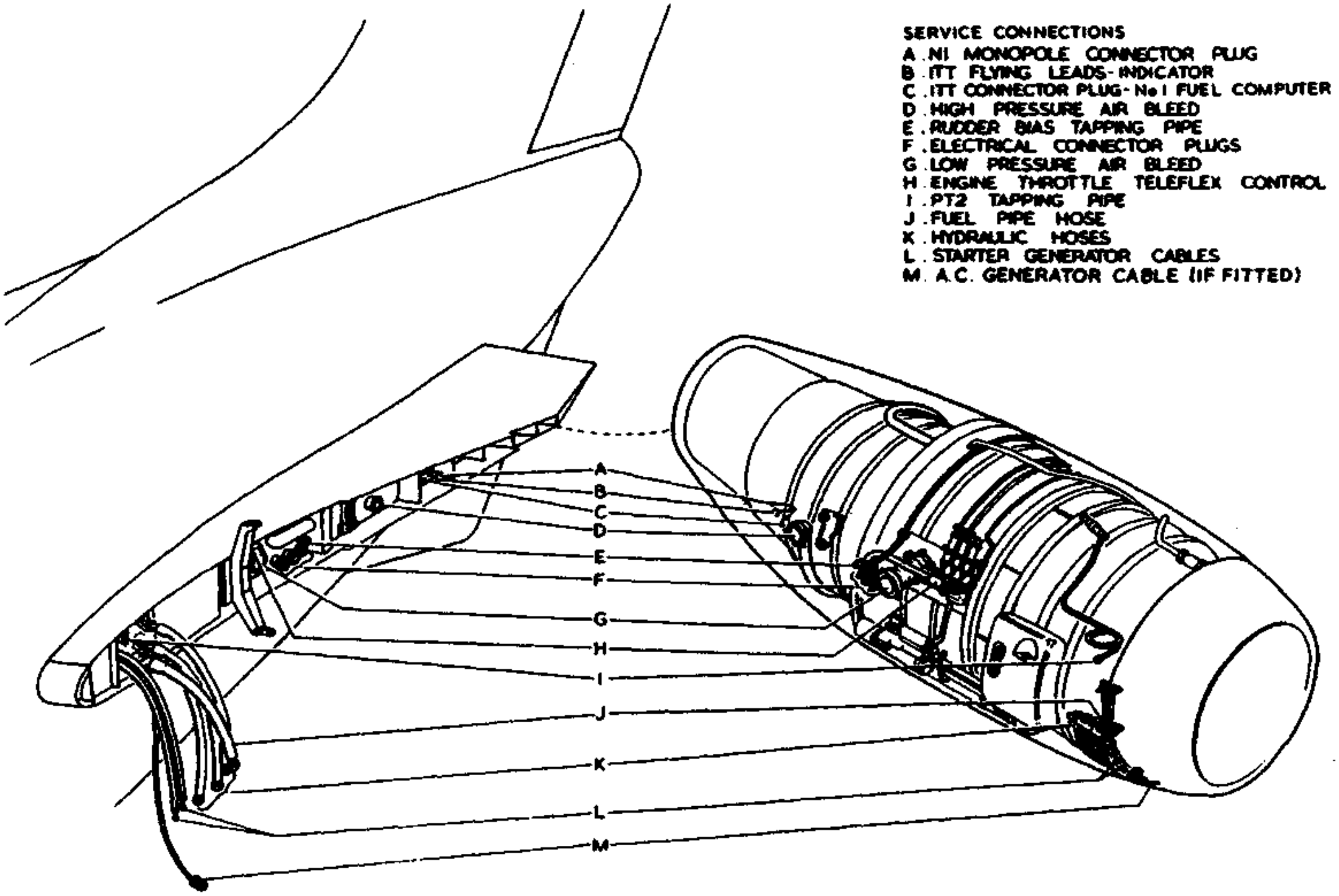
  (e) Fuel control unit.

  (f) Disconnect drains mounting plate and cables P-clip from engine but retain plate attachment nut. Disconnect cables P-clip from plate.

  (g) Loosen bolts clamping the mounting plate assembly to the drive breather vent.

  (h) Remove the drains assembly.

  (i) Unscrew pipe adapters from engine, discard O-ring seals and transfer adapters to their respective pipes.

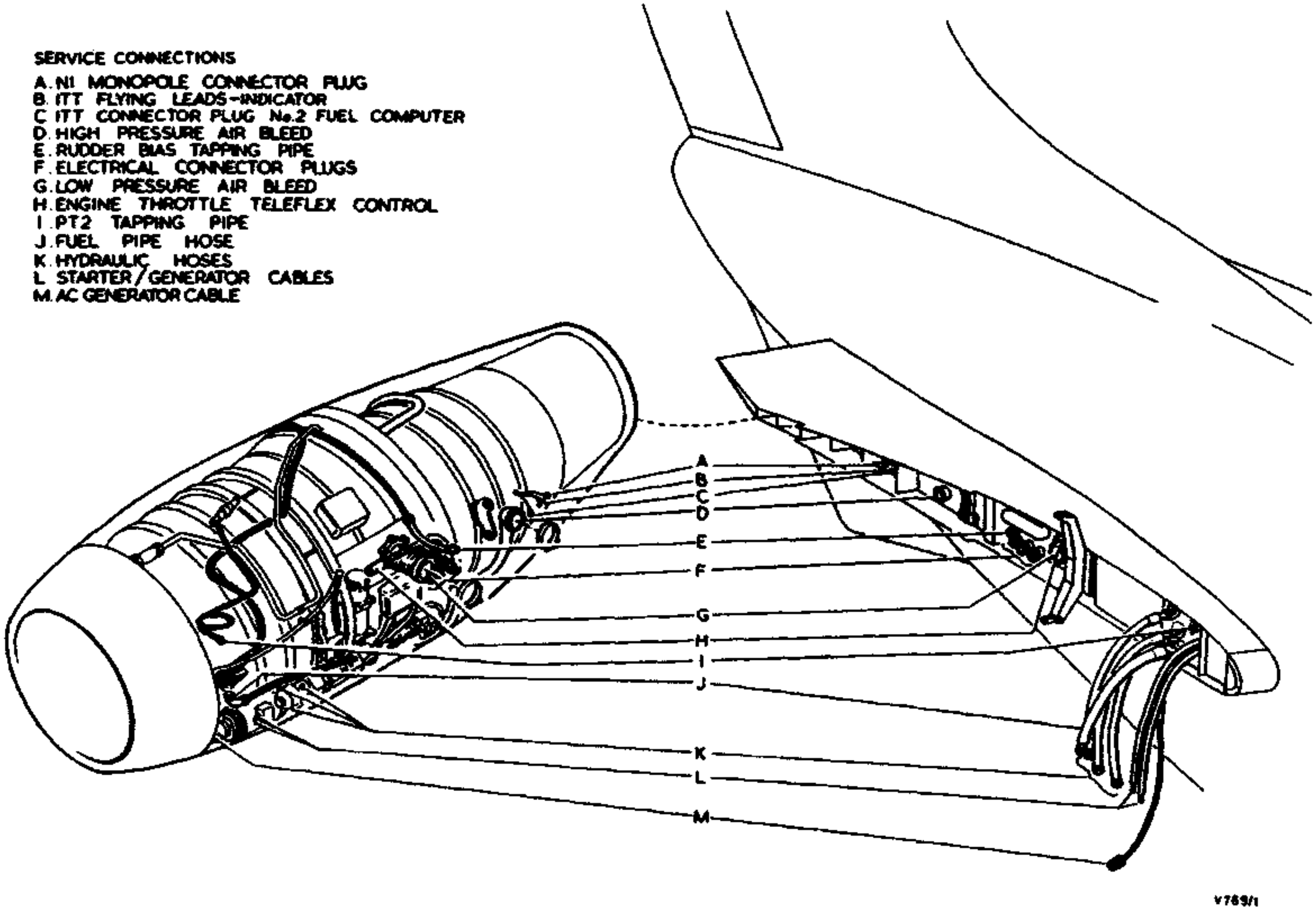


SERVICE CONNECTIONS
A. NI MONOPOLE CONNECTOR PLUG
B. ITT FLYING LEADS-INDICATOR
C. ITT CONNECTOR PLUG-No 1 FUEL COMPUTER
D. HIGH PRESSURE AIR BLEED
E. RUDDER BIAS TAPPING PIPE
F. ELECTRICAL CONNECTOR PLUGS
G. LOW PRESSURE AIR BLEED
H. ENGINE THROTTLE TELEFLEX CONTROL
I. PT2 TAPPING PIPE
J. FUEL PIPE HOSE
K. HYDRAULIC HOSES
L. STARTER GENERATOR CABLES
M. A.C. GENERATOR CABLE (IF FITTED)

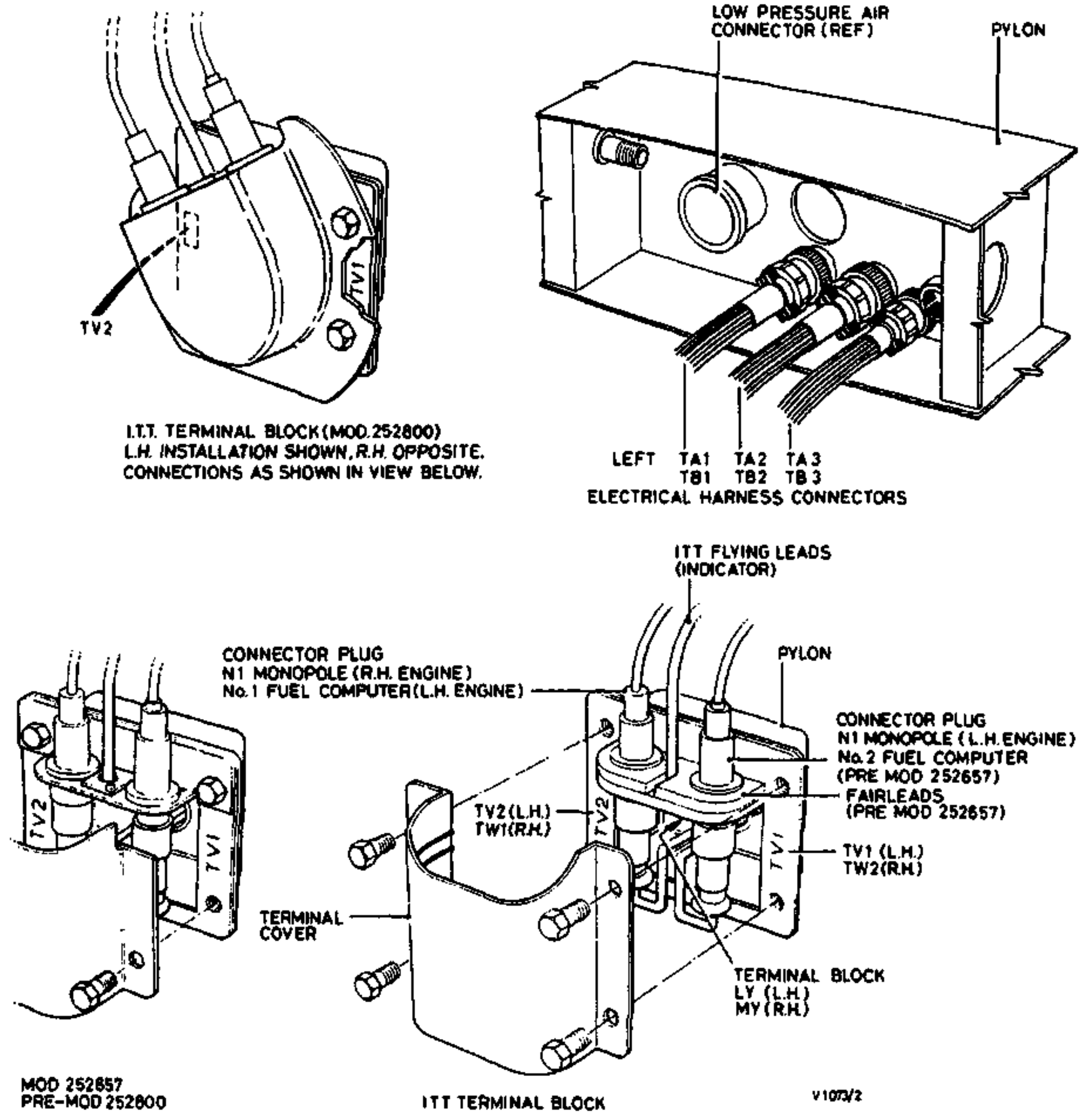
Power plant services connections - left engine
*Figure A401 (Sheet 1 of 2)*

SERVICE CONNECTIONS

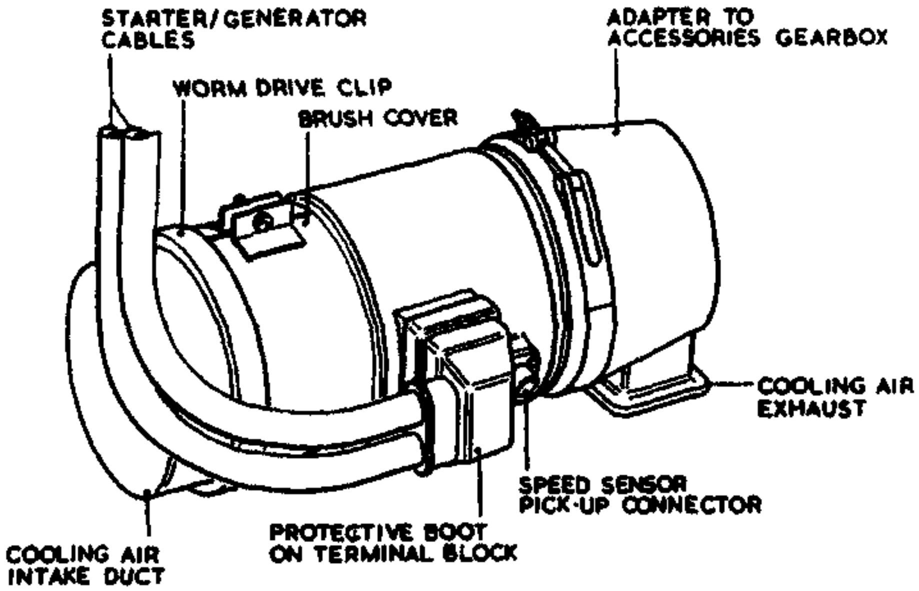
A. N1 MONOPOLE CONNECTOR PLUG
B. ITT FLYING LEADS-INDICATOR
C. ITT CONNECTOR PLUG No.2 FUEL COMPUTER
D. HIGH PRESSURE AIR BLEED
E. RUDDER BIAS TAPPING PIPE
F. ELECTRICAL CONNECTOR PLUGS
G. LOW PRESSURE AIR BLEED
H. ENGINE THROTTLE TELEFLEX CONTROL
I. PT2 TAPPING PIPE
J. FUEL PIPE HOSE
K. HYDRAULIC HOSES
L. STARTER/GENERATOR CABLES
M. AC GENERATOR CABLE



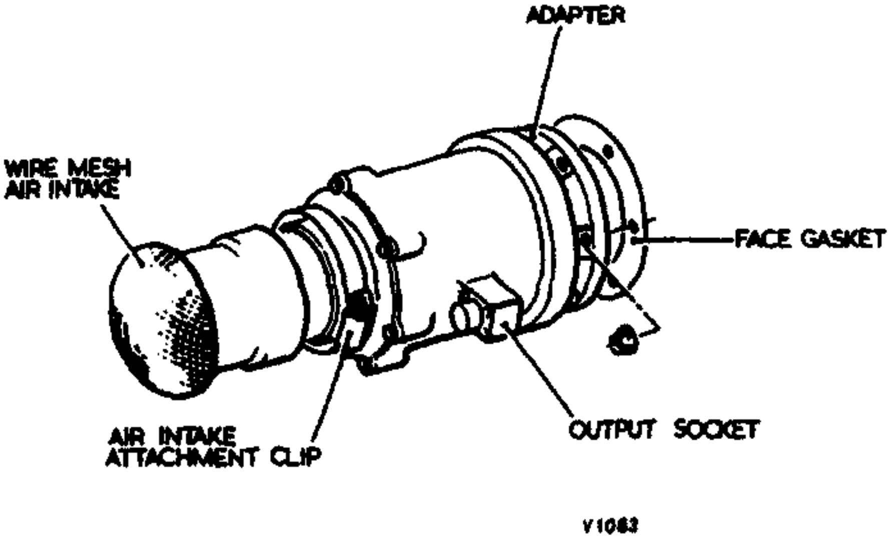
Power plant services connections - right engine
*Figure A401 (Sheet 2 of 2)*



Power plant services connections details - electrical
*Figure A402*


STARTER/GENERATOR CABLES
WORM DRIVE CLIP
BRUSH COVER
ADAPTER TO ACCESSORIES GEARBOX
COOLING AIR EXHAUST
SPEED SENSOR PICK-UP CONNECTOR
PROTECTIVE BOOT ON TERMINAL BLOCK
COOLING AIR INTAKE DUCT

STARTER / GENERATOR



AC GENERATOR

Power plant generators - connection details
*Figure A403*

(j) Unscrew and remove breather vent, discard O-ring seal and slip breather vent into drains assembly clip.

(k) Seal off breather vent and pipe apertures on engine.

**WARNING: AN A.C. GENERATOR WEIGHS 20 LB.**

(7) Remove a.c. generator and adapter- right engine or left engine (if installed):

(a) Support generator, release V-clamp and withdraw generator keeping it aligned until its driving shaft disengages. Remove generator complete with air intake mesh guard.

(b) Disconnect generator mounting adapter using a torque wrench in conjunction with torque wrench adapter *(refer to Equipment required,* paragraph *2.), remove the mounting adapter,* discard the face gasket but retain the mounting nuts.

(c) Seal off aperture on accessories drive gearbox.

**WARNING: A STARTER/GENERATOR WEIGHS 35 LB.**

(8) Remove starter/generator and adapter:

(a) *Release clip securing the flexible cooling air inlet duct to starter/generator. Release the air* inlet duct.

(b) Support starter/generator, release V-clamp and withdraw starter generator keeping it aligned until its drive shaft disengages. Remove the starter/generator.

(c) Disconnect starter/generator adapter mounting nuts. Remove the adapter, discard the face gasket but retain the mounting nuts.

(d) Seal off aperture on accessories drive gearbox.

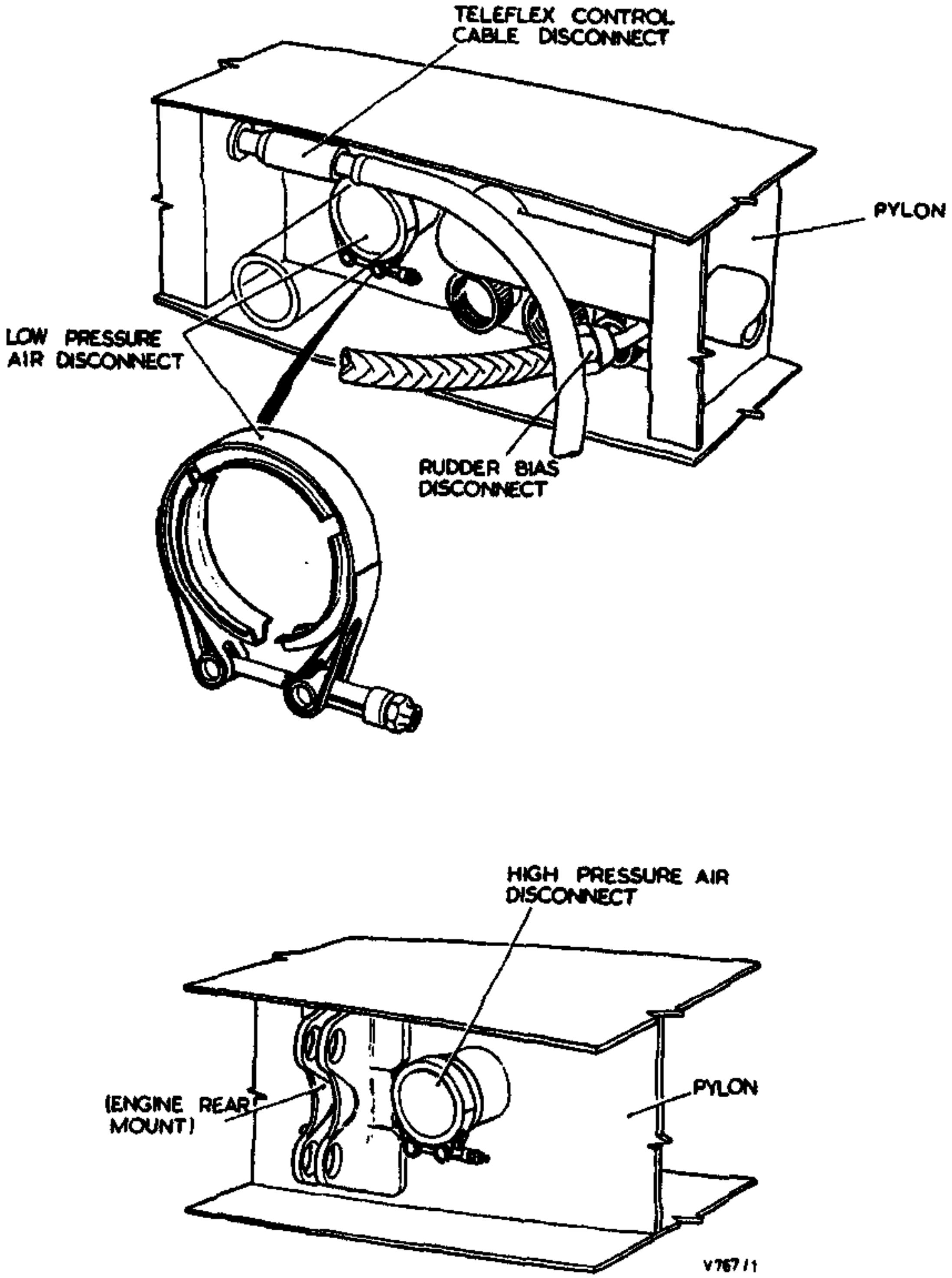
(9) Left engine - Disconnect hydraulic/fuel pipes and hydraulic pump:

(a) Disconnect flexible fuel and hydraulic pipes at the bracket mounting unions. Allow residual fuel and fluid to drain off into a container then seal off pipes and unions.

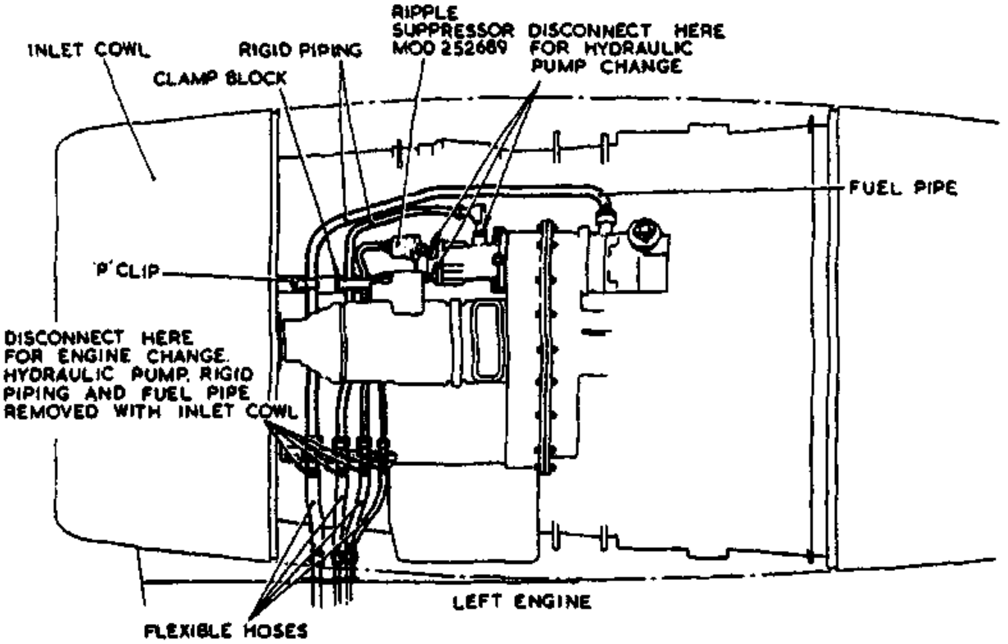
(b) Disconnect the rigid fuel pipe from the engine. Retain pipe attachment nuts but discard O-ring seal. Seal off pipe and engine apertures.

(c) At the *hydraulic pump, disconnect the cable P-clip bracket then disconnect and remove the* remaining pump mounting nuts.

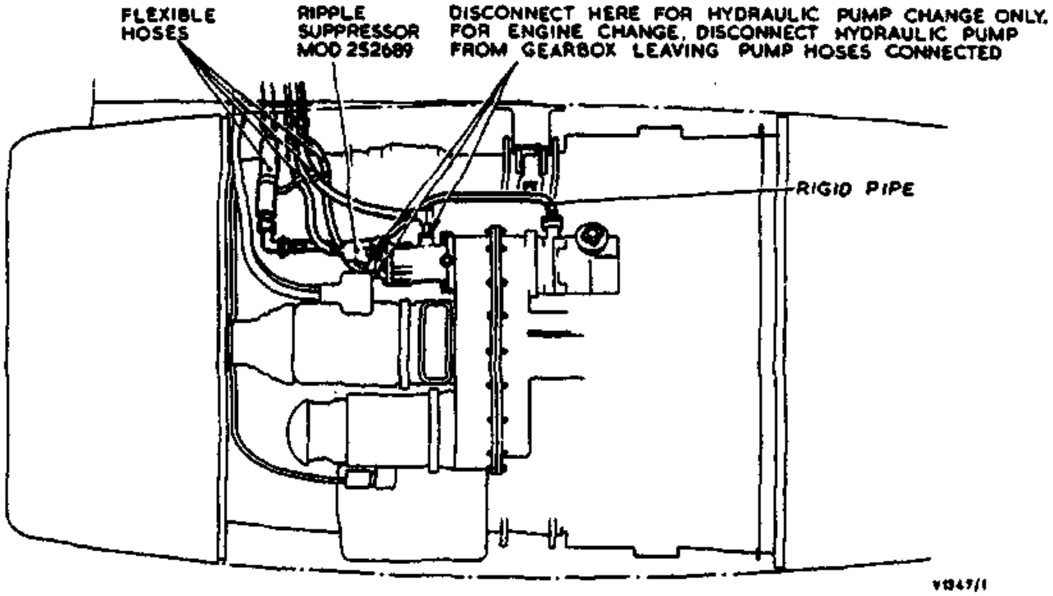
*NOTE: The pump will be removed with the inlet cowl.*


TELEFLEX CONTROL CABLE DISCONNECT
PYLON
LOW PRESSURE AIR DISCONNECT
RUDDER BIAS DISCONNECT
HIGH PRESSURE AIR DISCONNECT
(ENGINE REAR MOUNT)
PYLON
V767 / 1

Power plant services connections details - Mechanical
*Figure A404 (Sheet 1 of 2)*


INLET COWL
RIGID PIPING
RIPPLE SUPPRESSOR MOD 252689
DISCONNECT HERE FOR HYDRAULIC PUMP CHANGE
CLAMP BLOCK
FUEL PIPE
'P' CLIP
DISCONNECT HERE FOR ENGINE CHANGE. HYDRAULIC PUMP, RIGID PIPING AND FUEL PIPE REMOVED WITH INLET COWL
FLEXIBLE HOSES

LEFT ENGINE


FLEXIBLE HOSES
RIPPLE SUPPRESSOR MOD 252689
DISCONNECT HERE FOR HYDRAULIC PUMP CHANGE ONLY. FOR ENGINE CHANGE, DISCONNECT HYDRAULIC PUMP FROM GEARBOX LEAVING PUMP HOSES CONNECTED
RIGID PIPE
V1947/1

RIGHT ENGINE

Power plant services connections - Mechanical
*Figure A404 (Sheet 2 0f 2)*

(10) Right engine - Disconnect hydraulic/fuel pipes and hydraulic pump:

(a) Disconnect flexible fuel pipe at the bracket mounted elbow. Seal off the apertures on the rigid and flexible pipes.

(b) Disconnect the rigid fuel pipe from the engine. Retain pipe attachment nuts but discard O-ring seal. Seal off pipe and engine apertures.

(c) Disconnect and remove hydraulic pump mounting nuts. Withdraw the pump, keeping it aligned until its driving shaft disengages.

(d) Leave the hydraulic pump connected to its flexible pipes but tie up the pump to take the weight off the flexible pipes.

**CAUTION: DO NOT ALLOW PUMP TO HANG ON PIPES.**

(11) Disconnect inlet cowl services:

(a) Disconnect the electrical connector from the anti-ice valve solenoid coded LL (left engine) or ML (right engine).

(b) Remove the V-clamp from the air duct joint at the outlet side of the cowl inlet shut-off valve.

(c) Disconnect the electrical harness from the inlet anti-ice pressure switches coded LS and LT (left) engine or MS and MT (right) engine.

(d) Unclip the pressure switches harness leads from the inlet cowl attachment flange (4 clips). Retain bolts, nuts, washers to their respective clips.

(e) Disconnect and remove PT2 pipe complete with P-clips and mounting brackets.

(f) Unclip the fire detection sensor from the three brackets on the lower reach of the engine fan casing. Retain the sensor support slotted bushes.

(12) Support the oil tank by lashing it to the engine.

(13) Remove the bolts and washers securing the oil tank mounting brackets to the engine fan housing.

(14) Remove all nuts, washers and bolts (except top center) from the inlet cowl/engine fan casing attachment flange.

(15) Left engine - Remove inlet cowl:

(a) Support the inlet cowl and hydraulic pump.

(b) Remove the top center nut, washer and bolt.

(c) Slowly withdraw the inlet cowl forward, keeping the hydraulic pump aligned until its drive shaft disengages.

(d) Remove the inlet cowl complete with fuel pipe, hydraulic pipes and pump when all parts are clear of the engine.

(e) Lay the assembly on a clean and protected surface.

(f) Seal off the engine fan casing intake.

(g) Retain the three fire detection sensor brackets.

(16) Right engine - Remove inlet cowl:

(a) Support the inlet cowl.

(b) Remove the top center nut, washer and bolt.

(c) Slowly withdraw the inlet cowl forward, making sure that the fuel pipe incurs no damage during withdrawal.

(d) Remove the inlet cowl complete with fuel pipe.

(e) Lay the assembly on a clean and protected surface.

(f) Seal off the engine fan casing intake.

(g) Retain the three fire detection sensor brackets.

(17) Disconnect and remove the aft cowl assembly top and bottom outer closing panels at the engine rear mount *(Figure A405).*

(18) Disconnect the aft cowl assembly upper panel and lower panel assembly from the inner skin:

(a) Remove the bolts etc. attaching the upper panel and lower panel assembly to the rear angle on the aft cowl inner skin. Stow the attachments in the aide-memoire panel as they are removed.

(b) Remove the bolts etc. - from the longitudinal edges of the upper panel and lower panel assembly and aft cowl inner skin. Stow the attachments in the aide-memoire panel.

*NOTE: At this stage the upper panel and lower panel assembly are left connected to the attachment flange on the engine.*

(19) Disconnect the electrical leads and pipes from their P-clips on the aft cowl forward diaphragm.

(20) Support the aft cowl assembly then remove nuts, washers and bolts from the aft cowl/engine fan duct flange (except at attachment locations 10-19 (left engine) or 37-46 (right engine)).

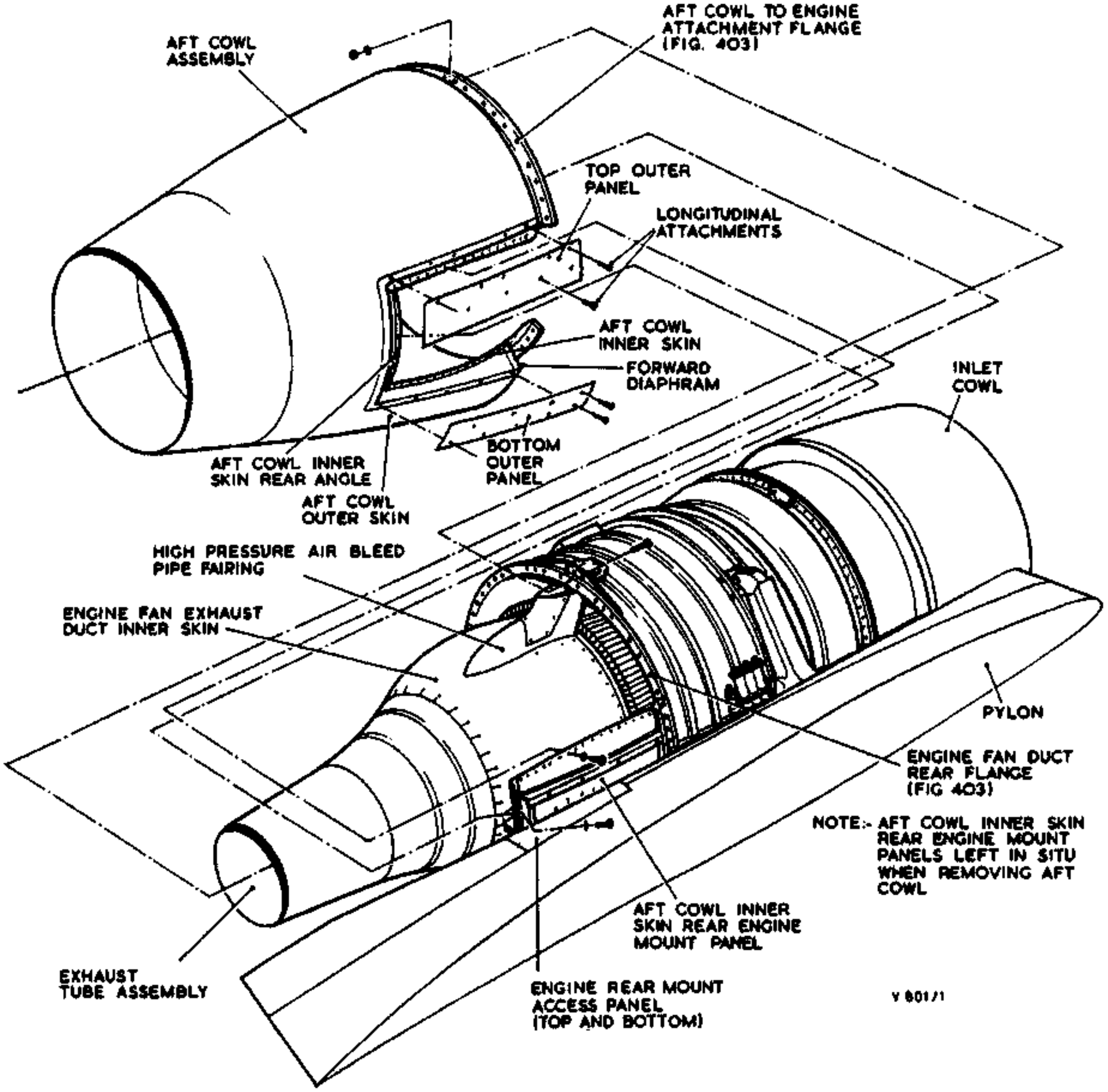
(21) Withdraw the aft cowl assembly rearwards.

(22) Remove fan exhaust duct inner top and bottom skin panels *(Figure A406)*:

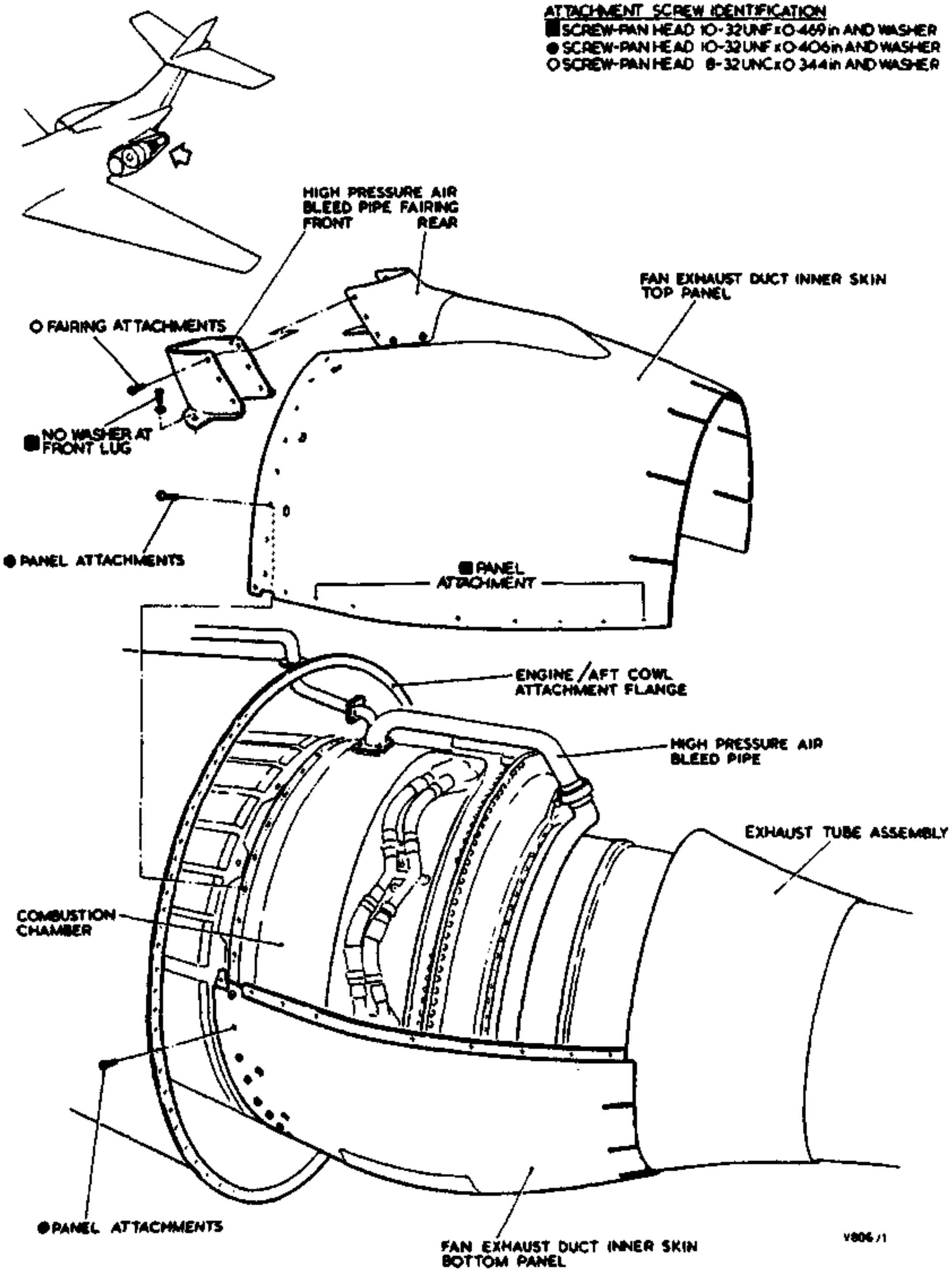
(a) Remove screws and washers securing the high pressure air bleed pipe front fairing to top panel. Remove the fairing.

(b) Remove screws and washers from top panel forward periphery and longitudinal lap joints. Remove top panel.

(c) Support bottom panel, remove screws and washers at forward periphery. Remove bottom panel.


AFT COWL ASSEMBLY
AFT COWL TO ENGINE ATTACHMENT FLANGE (FIG. 403)
TOP OUTER PANEL
LONGITUDINAL ATTACHMENTS
AFT COWL INNER SKIN
FORWARD DIAPHRAM
INLET COWL
BOTTOM OUTER PANEL
AFT COWL INNER SKIN REAR ANGLE
AFT COWL OUTER SKIN
HIGH PRESSURE AIR BLEED PIPE FAIRING
ENGINE FAN EXHAUST DUCT INNER SKIN
PYLON
ENGINE FAN DUCT REAR FLANGE (FIG 403)
NOTE:- AFT COWL INNER SKIN REAR ENGINE MOUNT PANELS LEFT IN SITU WHEN REMOVING AFT COWL
AFT COWL INNER SKIN REAR ENGINE MOUNT PANEL
EXHAUST TUBE ASSEMBLY
ENGINE REAR MOUNT ACCESS PANEL (TOP AND BOTTOM)
V 801/1

Aft cowl removal
*Figure A405*


ATTACHMENT SCREW IDENTIFICATION
■ SCREW-PAN HEAD 10-32UNF x 0.469in AND WASHER
● SCREW-PAN HEAD 10-32UNF x 0.406in AND WASHER
○ SCREW-PAN HEAD 8-32UNC x 0.344in AND WASHER
HIGH PRESSURE AIR BLEED PIPE FAIRING
FRONT
REAR
FAN EXHAUST DUCT INNER SKIN TOP PANEL
○ FAIRING ATTACHMENTS
■ NO WASHER AT FRONT LUG
● PANEL ATTACHMENTS
■ PANEL ATTACHMENT
ENGINE/AFT COWL ATTACHMENT FLANGE
HIGH PRESSURE AIR BLEED PIPE
EXHAUST TUBE ASSEMBLY
COMBUSTION CHAMBER
● PANEL ATTACHMENTS
FAN EXHAUST DUCT INNER SKIN BOTTOM PANEL
V806/1

Fan exhaust duct inner top and bottom panels removal
*Figure A406*

(23) Remove exhaust tube assembly.

  (a) Support the exhaust tube assembly.

  (b) Unscrew the exhaust pipe clamp T-bolt self-locking high temperature nuts, remove the clamp and withdraw the exhaust tube assembly rearwards.

  (c) Seal off the exhaust fan duct aperture on the engine.

(24) Disconnect electrical connectors and remove electrical harness coded TA1 (left engine) or TB1 (right engine) *Figure A415* (left engine) or *Figure A416* (right engine):

  (a) Fuel filter pressure switch, coded LE (left engine) or ME (right engine).

  (b) Fuel high temperature switch, coded LG (left engine) or MG (right engine).

  *NOTE: This is a Jiffy connector.*

  (c) Igniter, coded LJ (left engine) or MJ (right engine).

  (d) PT2/TT2 heater, coded LK (left engine) or MK (right engine).

  (e) Inlet anti-ice pressure (FLT) switch, coded LS (left engine) or MS (right engine).

  (f) Inlet anti-ice pressure (GND) switch, coded LT (left engine) or MT (right engine).

  (g) Inlet shut-off valve solenoid, coded LL (left engine) or ML (right engine).

  (h) Pre-Mod.252718 only. PcD pressure switch, coded LM (left engine) or MM (right engine).

  (i) Anti-ice valve solenoid, coded LD (left engine) or MD (right engine).

  (j) Fuel flow transmitter, coded LH (left engine) or MH (right engine).

  (k) Oil low pressure switch, coded LQ (left engine) or MQ (right engine).

  (l) Oil pressure transmitter, coded LN (left engine) or MN (right engine).

  (m) Oil temperature bulb, coded LP (left engine) or MP (right engine).

(25) Disconnect and remove cable heat shield located between igniter, coded LJ and anti-ice valve solenoid, coded LD (left engine) or MJ and MD (right engine). Retain mounting bolts/nuts to shield.

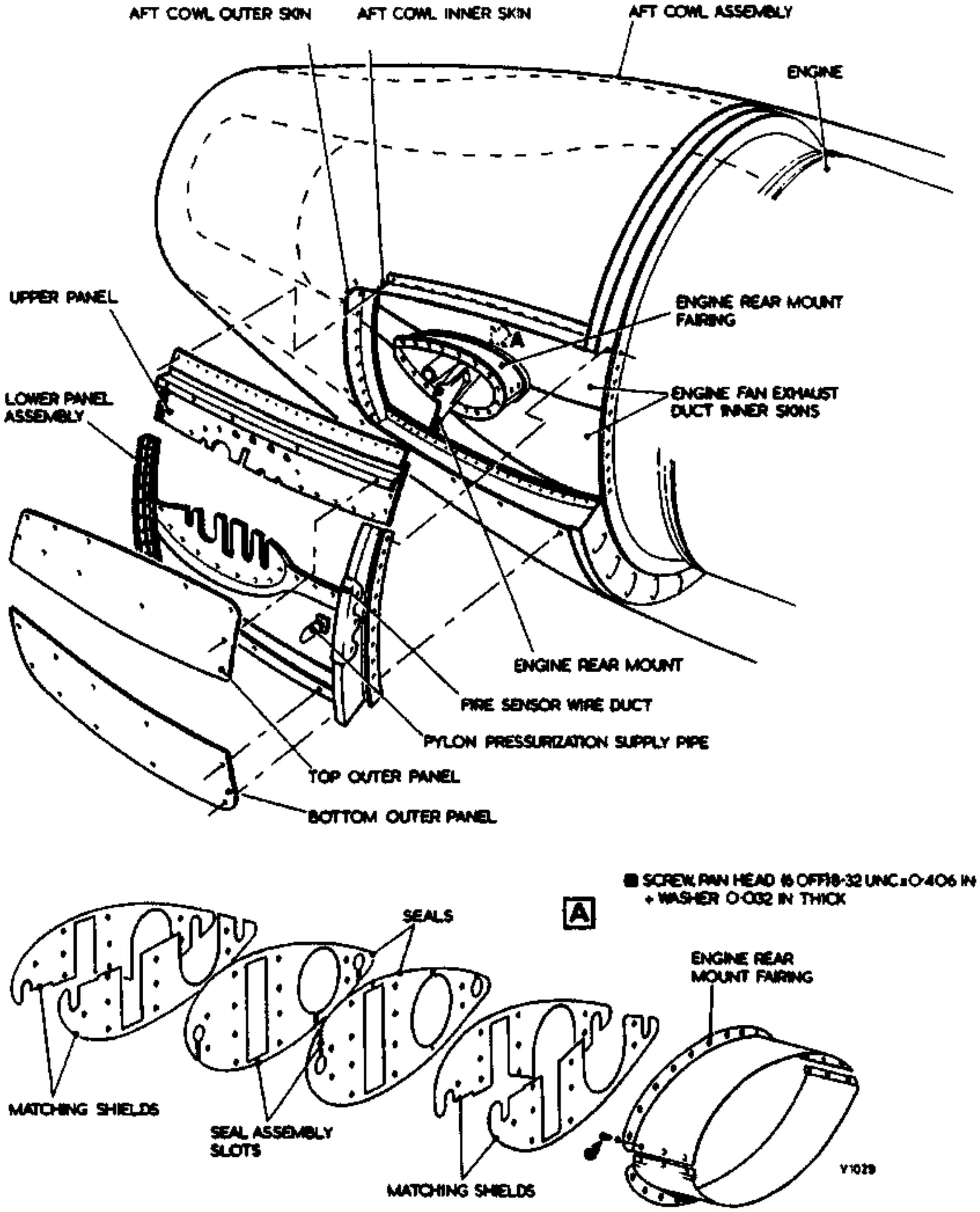
(26) Release remaining P-clips leaving them on the harness and retain attachment bolts, washers and nuts to their respective P-clips.

(27) Unthread and remove harness.

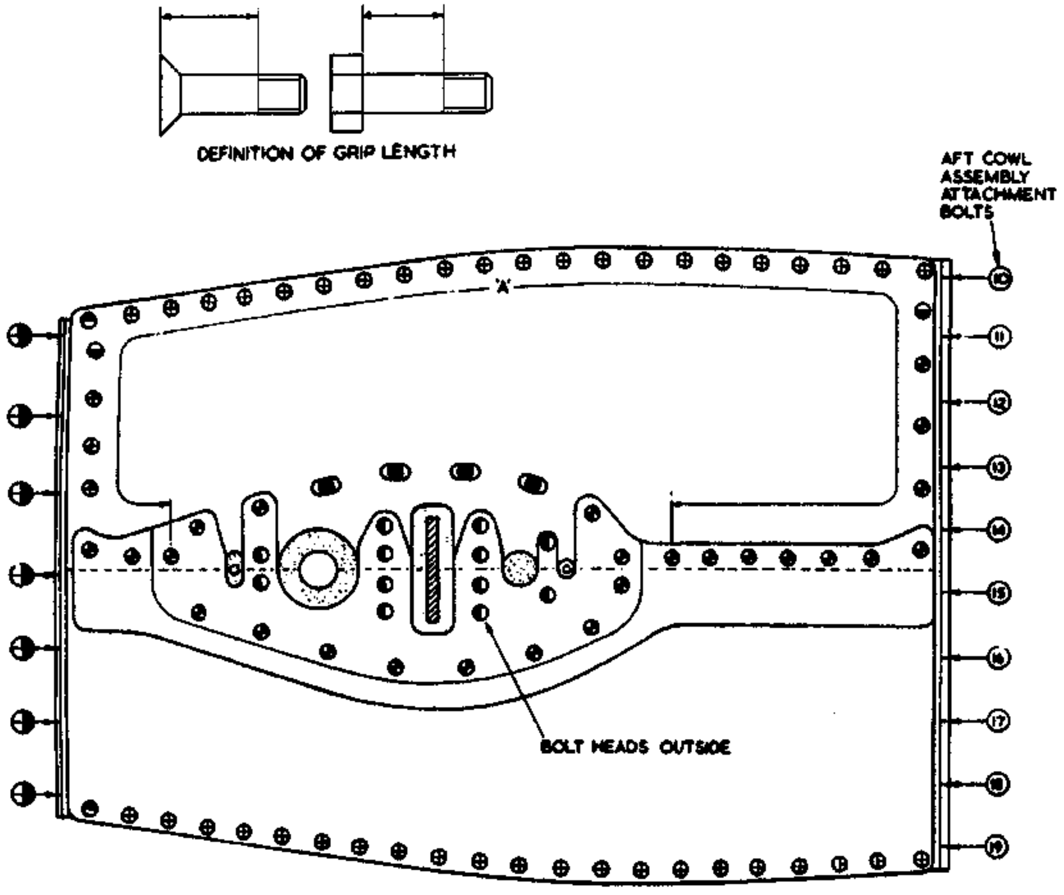
(28) Remove electrical harness, coded TA3 (left engine) or TB3 (right engine):

  (a) Remove remaining P-clips leaving them on the harness. Retain attachment bolts, washers and nuts to their respective P-clips.

  (b) Remove the harness.



Engine rear mount fairings
*Figure A407*



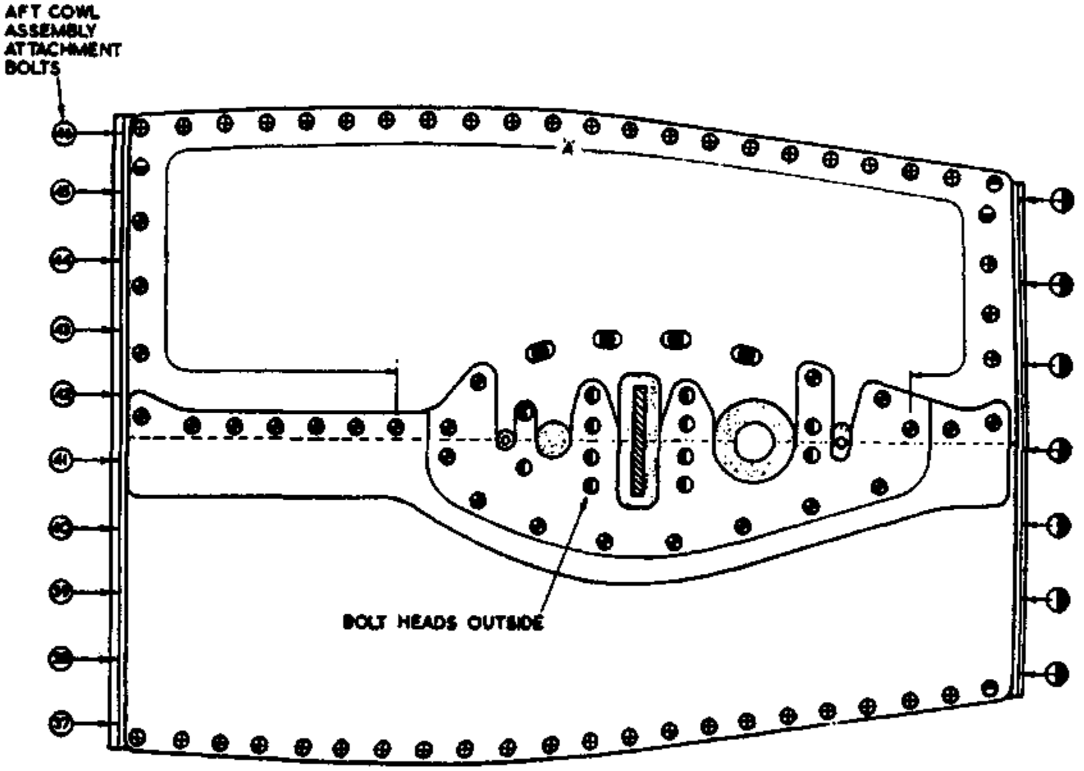
**NOTE**
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY VACATE TO FACILITATE SUBSEQUENT CORRECT ASSEMBLY.

- ● SCREW-CSK-10-32 UNF x 0.18 IN
- ⊖ SCREW-CSK-10-32 UNF x 0.23 IN + THIN WASHER + LOCKNUT
- ⊕ SCREW-CSK-10-32 UNF x 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT
- ⊕ SCREW-CSK-10-32 UNF x 0.23 IN + LOCKNUT
- ⊕ SCREW-CSK-10-32 UNF x 0.23 IN
- ◐ BOLT-HEX HD-10 UNF 2A x 0.50 IN + LOCKNUT
- ⊕ BOLT-HEX HD-10-32UNF x 0.250 IN + THIN WASHER
- ⊖ BOLT-HEX HD-10-32UNF x 0.312 IN + THIN WASHER
- ⊕ BOLT-HEX HD-10-32UNF x 0.125 IN

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

V1036

Engine rear mount fairing attachments
*Figure A408 (Sheet 1 of 2) - left engine*



● SCREW-CSK-10-32UNF × 0.18 IN
⊖ SCREW-CSK-10-32UNF × 0.23 IN + THIN WASHER + LOCKNUT
⊕ SCREW-CSK-10-32UNF × 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT
⊕ SCREW-CSK 10-32UNF × 0.23 IN + LOCKNUT
⊘ SCREW-CSK-10-32UNF × 0.23 IN
◐ BOLT-HEX HD-10UNF 2A × 0.50 IN + LOCKNUT
⊕ BOLT-HEX HD-10-32UNF × 0.250 IN + THIN WASHER
⊖ BOLT-HEX HD-10-32UNF × 0.312 IN + THIN WASHER
⊖ BOLT-HEX HD-10-32UNF × 0.125 IN

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

V1037

NOTE
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY VACATE TO FACILITATE SUBSEQUENT CORRECT ASSEMBLY.

Engine rear mount fairing attachments
*Figure A408 (Sheet 2 of 2) - right engine*

(29) Remove engine rear mount fairing *(Figures A407 and A408)*:

(a) Remove bolts, washers, nuts securing the upper and lower fairings. Stow bolts etc. in aide memoire panel.

(b) Remove bolts, washers, nuts securing the matching shields and seals. Stow bolts etc. in aide memoire panel.

(c) Remove remaining bolts and nuts from upper panel. Stow bolts etc. in aide memoire panel.

(30) Remove fire detection sensor complete with detector *(Figure A414)*:

(a) At the engine fan exhaust efflux flange disconnect sensor retaining clips 1-9. Remove 9 slotted bushes.

*NOTE: There are 21 clips securing the sensor to the engine and for descriptive purposes are numbered 1-21 from the blank end of the sensor.*

(b) Disconnect clip brackets 10-12, leaving brackets on sensor.

(c) At the engine mount rear fairing lower panel assembly, extract slotted bushes from the locating distance tube and carefully thread the sensor through the tube making sure that the sensor does not kink.

(d) Disconnect the detector mounting bracket complete with detector. Retain 2 washers, bolt and nut (left engine) or 2 bolts and nut (right engine).

(e) Disconnect remaining sensor mounting brackets leaving them on the sensor. Retain attachment bolts to their respective brackets, carefully remove the detector/sensor assembly, avoiding any kinking.

(31) Remove bolts 10-19 (left engine) or 37-46 (right engine) then remove lower panel assembly.

(32) Remove accessories at fuel-charged oil cooler and fuel pump:

(a) Disconnect fuel pipe from special adapter on the fuel flow transmitter. Seal off inlet fuel pipe and special adapter.

(b) Unscrew and remove fuel flow transmitter complete with special inlet and outlet adapters and O-ring seal. Discard O-ring seal and seal off outlet adapter and aperture on oil cooler.

(c) Disconnect pipe from oil pump and seal off oil pump and pipe.

(d) Disconnect and remove mounting bracket complete with oil low pressure switch, transmitter and oil pipe. Attach mounting bolts and nuts to bracket.

(e) Unscrew and remove oil temperature bulb complete with O-ring seal from oil pump. Discard O-ring seal and seal off oil pump and temperature bulb.

(f) Unscrew and remove fuel high temperature switch complete with O-ring seal and flying leads. Discard O-ring seal and seal off switch and aperture on engine.

(33) Remove engine output/high pressure pipe assembly *(Figure A409)*.

(a) Working from the airframe end, disconnect the pipe from the engine mounted bracket, retain the washers, spacer, bolts and silver plated nuts.

*NOTE: Leave the pipe bracket on the pipe.*

(b) At the engine supply joint, remove bolts, washers, spacers and Lo-Load seal. Discard the seal.

(c) At the local pipe joint, remove and discard split pins. Release bolts, washers and silver-plated nuts. Discard the joint Lo-Load seal.

(d) At the pipe steady location adjacent to the engine/rear cowl attachment flange, remove and discard split pins. Remove bolts, washers and silver-plated nuts and electric cables clipping bracket. Remove spacer assembly, split retainer, seal housing, split seal and discard the seal. Extract the pipe assembly.

(34) Remove inlet shut-off valve and input piping:

(a) At the penultimate joint, disconnect and remove the clamp.

(b) At the adjacent pipe mounting bracket, remove the mounting bracket securing bolts, washers and silver-plated nuts, retain these parts.

(c) Remove the pipe complete with mounting brackets and valve.

(35) Remove low pressure air piping assembly:

(a) Remove the six bolts attaching the engine air supply fitting. Retain the bolts.

(b) Unbolt the piping support brackets (4 off) and remove the piping assembly, retain bolts and nuts to their respective brackets then remove the piping assembly.

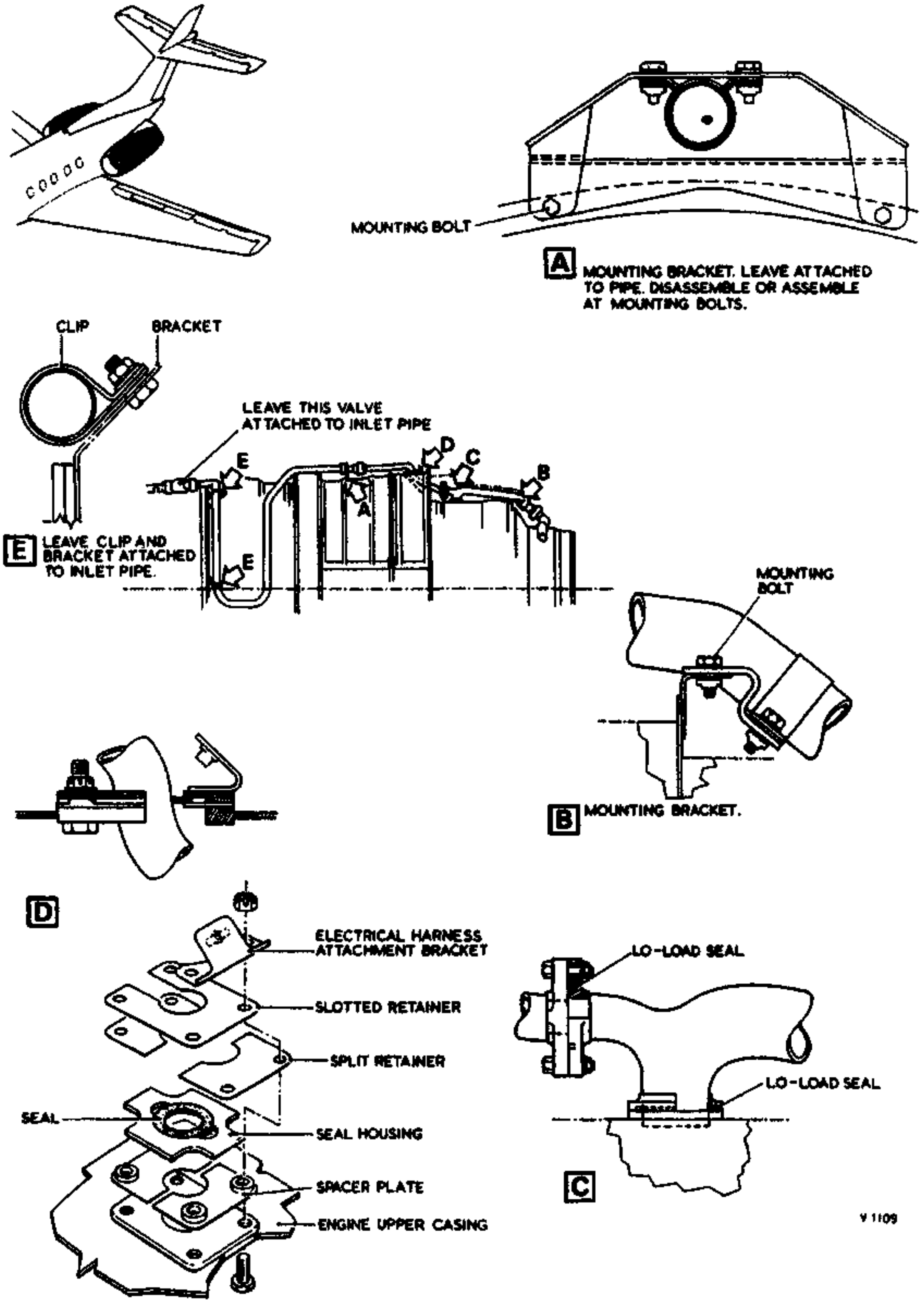
(c) Unbolt the low pressure air bleed connector (mixer valve supply) retain bolts but discard gasket.

(d) Seal off the supply apertures on the engine.

(36) Disconnect N1 monopole and ITT cable clipping *(Figure A413)*:

(a) Feed N1 and ITT monopole connectors and ITT indicator cables back from the pylon on to the engine.

(b) Disconnect and remove the P-clips, complete with fixing bolts and nuts, from four engine-mounted brackets at the hot end.


MOUNTING BOLT
A MOUNTING BRACKET. LEAVE ATTACHED TO PIPE. DISASSEMBLE OR ASSEMBLE AT MOUNTING BOLTS.
CLIP
BRACKET
LEAVE THIS VALVE ATTACHED TO INLET PIPE
E
D
C
B
A
E
E LEAVE CLIP AND BRACKET ATTACHED TO INLET PIPE.
MOUNTING BOLT
B MOUNTING BRACKET.
D
ELECTRICAL HARNESS ATTACHMENT BRACKET
SLOTTED RETAINER
SPLIT RETAINER
SEAL
SEAL HOUSING
SPACER PLATE
ENGINE UPPER CASING
LO-LOAD SEAL
LO-LOAD SEAL
C
V 1109

Installation of high and low pressure air piping
*Figure A409*

**D. Remove engine from aircraft**

(1) Prepare and suitably position power plant stand to receive removed engine.

(2) Position the hoisting equipment.

(3) Attach power plant sling to hook of hoisting equipment.

(4) Connect sling to the front and rear slinging points as shown on *Figure A410.*

(5) Remove all extraneous tools and gear from the work area.

**CAUTION: NOW MAKE SURE THAT THE ENGINE MOUNTS ARE THE ONLY CONNECTION BETWEEN THE PYLON AND ENGINE.**

(6) Take the initial weight of the engine with the hoisting equipment.

(7) Disconnect engine rear mount *(Figure A411)*:

(a) Remove split pin, nut, washers and bolt (3) from the engine attachment lug. Discard the split pin.

*NOTE: Before removing bolt (3) make sure that it is in a 'no load' condition by adjusting the height of the power plant sling. Under no circumstances may the bolt be screwed out during its removal.*

(8) Disconnect the engine front mount link from the bottom attachment assembly:

(a) Remove the split pin, nut and washers from bolt (2). Discard the split pin.

(b) Remove bolt (2), with special thick washer under the head, as the weight of the engine is being taken. Extract short and long bushes.

(c) Rotate the link clear of the bottom attachment assembly.

(9) Disconnect engine front mount top attachment from the pylon yoke:

(a) Remove split pin from attachment nut. Discard split pin.

(b) Remove slotted nut, standard washers and special thick washer.

(c) Withdraw bolt (1) leaving the special thick washer under the head. Extract short and long bushes.

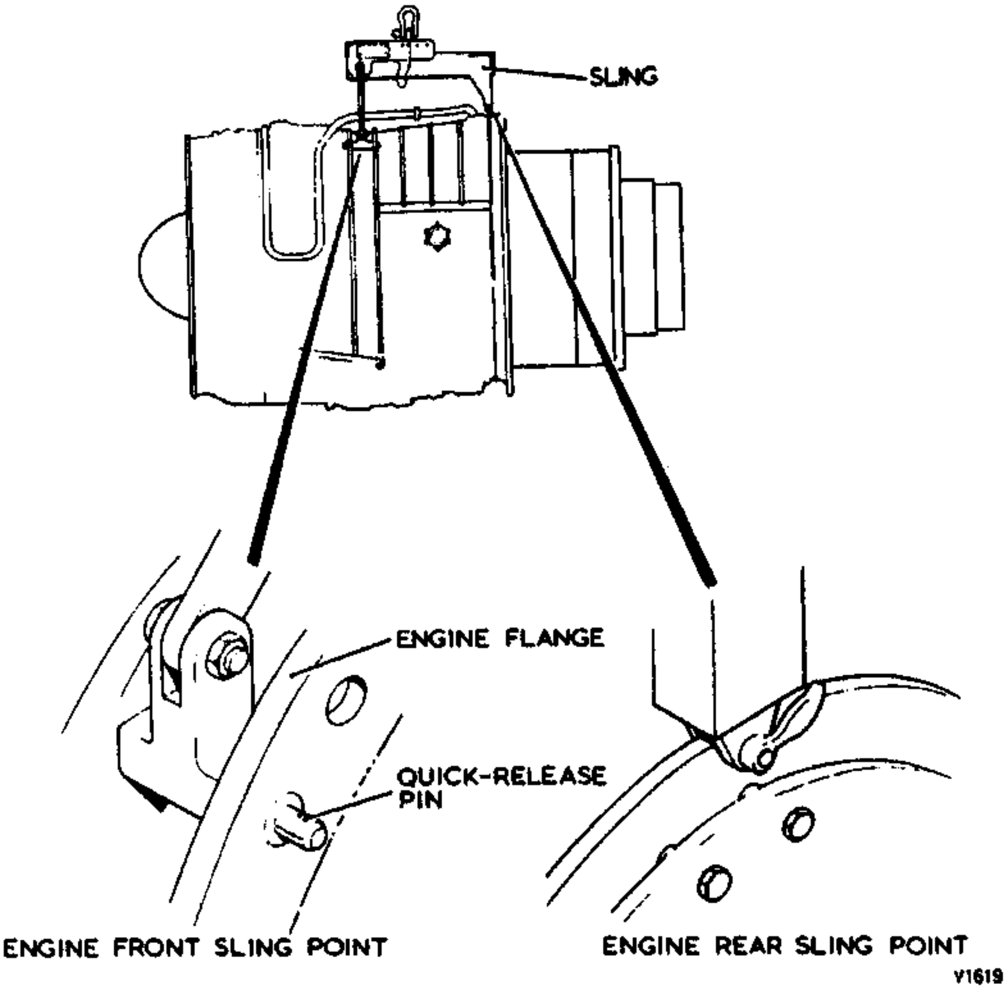
(10) Ease the engine outboard clear of the pylon.

*NOTE: Paragraphs (11) and (12) not applicable if replacement engine has been converted from a non-basic 125 engine (for example) TFE 731-3-1F.*

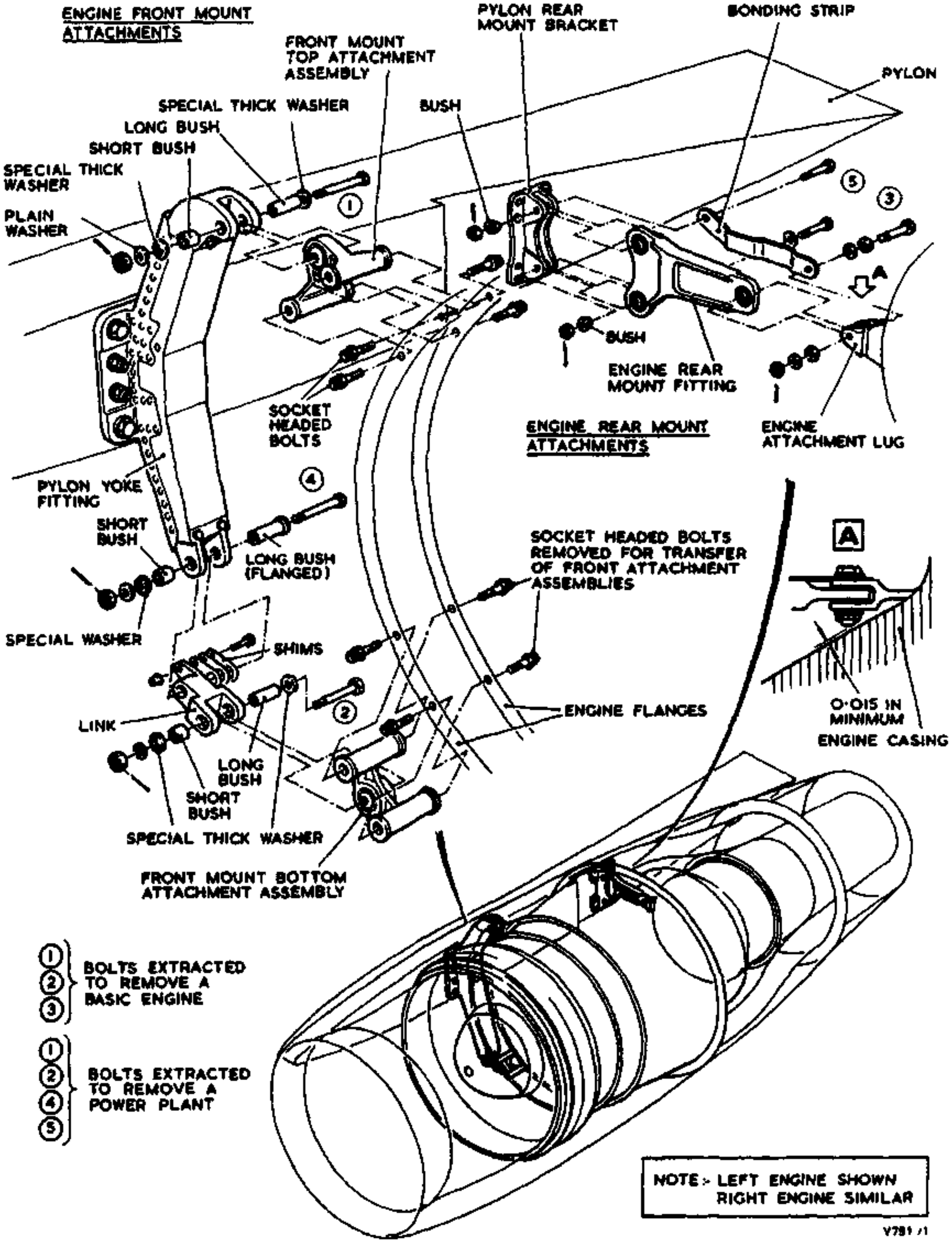
(11) Remove engine front mount top attachment assembly:

(a) Remove the four socket-headed bolts securing the top attachment assembly to the engine case flanges.

(b) Remove the top attachment assembly, retain the bolts to the attachment assembly but make sure bushes (4 off) remain with the engine.



Engine sling
*Figure A410*


ENGINE FRONT MOUNT ATTACHMENTS
FRONT MOUNT TOP ATTACHMENT ASSEMBLY
PYLON REAR MOUNT BRACKET
BONDING STRIP
PYLON
SPECIAL THICK WASHER
BUSH
LONG BUSH
SHORT BUSH
SPECIAL THICK WASHER
PLAIN WASHER
①
⑤
③
A
BUSH
ENGINE REAR MOUNT FITTING
SOCKET HEADED BOLTS
ENGINE REAR MOUNT ATTACHMENTS
ENGINE ATTACHMENT LUG
PYLON YOKE FITTING
④
SHORT BUSH
LONG BUSH (FLANGED)
SOCKET HEADED BOLTS REMOVED FOR TRANSFER OF FRONT ATTACHMENT ASSEMBLIES
A
SPECIAL WASHER
SHIMS
LINK
②
ENGINE FLANGES
0·015 IN MINIMUM
ENGINE CASING
LONG BUSH
SHORT BUSH
SPECIAL THICK WASHER
FRONT MOUNT BOTTOM ATTACHMENT ASSEMBLY
① ② ③ BOLTS EXTRACTED TO REMOVE A BASIC ENGINE
① ② ④ ⑤ BOLTS EXTRACTED TO REMOVE A POWER PLANT
NOTE:- LEFT ENGINE SHOWN RIGHT ENGINE SIMILAR
V781/1

Power plant mount details
*Figure A411*

(12) Right engine only - Remove engine front mount bottom inboard attachment assembly:

(a) Remove the four socket-headed bolts securing the bottom attachment assembly to the engine case flanges.

(b) Remove the bottom attachment assembly, retain the bolts to the attachment assembly but make sure bushes (4 off) remain with the engine.

(13) Lower the engine on to the stand and secure.

*NOTE: Seal off any remaining apertures on the removed engine.*

(14) Remove lashing and re-secure oil tank.

Table A401(Series F400)
ENGINES - POWER SUPPLIES

| Circuit | | Sub-panel D - circuit breaker | Sub-panel E - circuit breaker | Panel ZK - fuse | Panel ZL - fuse |
|---|---|---|---|---|---|
| Fuel filter | Left<br>Right | -<br>- | -<br>- | -<br>- | F16<br>F17 |
| Fuel temperature | Left<br>Right | -<br>- | -<br>- | -<br>- | F18<br>F19 |
| Oil low pressure | Left<br>Right | -<br>- | -<br>- | -<br>- | F21<br>F22 |
| Oil temperature | Left<br>Right | -<br>- | B21<br>B22 | -<br>- | -<br>- |
| Oil pressure | Left<br>Right | B15<br>B16 | -<br>- | -<br>- | -<br>- |
| Fuel flowmeter | Left<br>Right | -<br>- | -<br>- | F38, F39<br>F38, F48 | -<br>- |
| Fire detection | Left<br>Right | -<br>B22 | -<br>- | -<br>- | F12<br>F11 |
| Eng/intake de-ice | Left<br>Right | B50<br>B51 | -<br>- | F24<br>F25 | -<br>- |
| Engine r.p.m. | Left<br>Right | -<br>- | -<br>- | F34, F35, F44, F45<br>F29, F30, F54, F55 | -<br>- |
| I.T.T. | Left<br>Right | -<br>- | -<br>- | F28<br>F28 | -<br>- |
| No.1 fuel computer | | - | - | F10, F31 | - |
| No.2 fuel computer | | - | - | F11, F20, F32 | - |
| Ignition | Left<br>Right | -<br>- | -<br>- | -<br>- | F5<br>F6 |

End of remove engine

## 2. Install engine

| Equipment/Material | Part/Item No. | |
|---|---|---|
| Power plant sling | 25-7Y9-A | |
| Power plant stand | 25-7Y-25A or equivalent | |
| Torque wrench adapter | SPL3652 | |
| Strap wrench capable of applying torque (lb in.) TG65-1 thru TG65-7 | (a) 26-30<br>(b) 46-50<br>(c) 70-75<br>(d) 120-130 | |
| Torque wrench capable of lb in. | (a) 15-16 1/2<br>(b) 20<br>(c) 25-30<br>(d) 30-35<br>(e) 35-45<br>(f) 40-44<br>(g) 45<br>(h) 50-55<br>(j) 55-65<br>(k) 60-66 | (l) 60-85<br>(m) 65-75<br>(n) 70-80<br>(o) 70-90<br>(p) 100<br>(q) 100-110<br>(r) 160-190<br>(s) 185-215<br>(t) 350-385 |

| Materials | Application |
|---|---|
| Grease, Aeroshell 17 or any grease quoted in Allied Signal, Light Maintenance Manual | Accessory gearbox front drive splines and all bolts and bushes associated with the engine front mountings |
| Engine oil | Non-engine nuts to be torque loaded |
| Fel-Pro C5A<br>Neverseez NSN 165B | Pipe/hose coupling threads and engine rear mount bolt (3) *(Figure A411)* |

**Parts required to install TFE 731-3-1H or 731-3R-1H engine**

| Nomenclature | Part No. | Alternative | Location | Qty |
|---|---|---|---|---|
| O-ring seal | 1000218815 | – | Fuel pipe to engine | 1 |
| O-ring seal | DHS1650A | –<br>– | Witness drains<br>Fuel temp switch | 1<br>1 |
| O-ring seal | DHS1650B | – | Witness drains | 4 |

**Parts required to install 731-3R-1H engine**

| Nomenclature | Part No. | Alternative | Location | Qty |
|---|---|---|---|---|
| O-ring.seal | DHS1650C | – | Fuel flow T/X inlet adapter | 1 |
| O-ring seal | DHS1650F | – | Engine breather | 1 |
| Gasket | MS 9135-01 | – | Hydraulic pump mounting | 1 |
| Gasket | MS 9136-01 | – | Starter/generator mounting<br>AC generator mounting | 1<br>1 |
| Split pin | MS 24665-191 | – | High pressure air piping | 12 |
| Lo-load seal | 612-A51-0012-2 | – | High pressure air piping | 1 |
| Lo-load seal | 612-A51-0020-2 | – | High pressure air piping | 1 |
| Seal | F10A-5-P20245-11 | – | High pressure air piping | 1 |
| Gasket | 3071235-1 | – | Low pressure air tapping | 2 |
| Split pin | SP90-E10 | – | Engine mounts | 1 |
| Split pin | MS 24665-231 | SP90-D8 | Engine mounts | 1 |
| Split pin | MS 24665-302 | SP90-E8 | Engine mounts | 2 |

**A. Prepare to install engine**

(1) Torque loadings:

(a) All torque loading figures quoted are the actual loadings required:

If an extension spanner is used between the torque spanner and the item being tightened, calculate the correct torque spanner dial reading required using the following expression:

$$R = \frac{T \times L}{L + E}$$

Where R = Indicated value on torque wrench

T = Actual torque value
L = Effective length of torque lever arm
E = Effective length of offset.

(b) Unless otherwise specified, nuts which are part of the basic engine as supplied by Garrett AiResearch, are torque loaded with dry threads, (no lubricant).

(c) Unless otherwise stated, certain nuts used for the assembly of items of equipment installed to build an engine up to power plant standard are torque loaded with wet threads i.e. engine oil lightly applied prior to the application of a specified torque load.

(2) Cleanliness:

(a) Remove any foreign matter which may have accumulated on the cowlings or pylon.

(3) Seals and gaskets:

(a) Where these items are part of the basic engine as supplied by Garrett AiResearch, they are discarded on disassembly. O-ring seals are also discarded on disassembly.

(4) Self-locking nuts:

(a) Garrett AiResearch supply nuts - Do not re-use.

(b) Other than Garrett AiResearch supply nuts - Check the run down torque manually:

Attempt to screw the self-locking nut on the bolt or stud beyond the locking section using maximum finger pressure. If the nut can be screwed beyond the locking section reject it. Select a new nut and repeat the check until satisfactory.

(c) General - During final assembly of self-locking nuts (after torque tightening), check to make sure that a minimum of one full thread (in addition to the chamfered portion of the bolt or stud end) is protruding beyond the outer face of the nut.

(5) Clearance of components:

(a) Check items which are to be transferred from one power plant to another have received inspection clearance.

(b) Make sure that any pre-installation checks, specified in the Maintenance Schedule, have been completed.

(6) Inspection of engine after receipt and before installation:

(a) Make sure that the replacement engine is to the approved standard (refer to Allied Signal, Light Maintenance Manual Report No.72-02-15, EQUIPMENT IDENTIFICATION LIST).

*NOTE: For the latest Report No. for this engine refer to Allied Signal Publications.*

*NOTE: Should a replacement engine of the approved standard not be available, refer to B401 page block of this Manual for details of an alternative engine modifiable to the approved standard.*

(b) Make sure that lines are secure and free from damage.

(c) Check for tag to determine if engine has been preserved. If engine has been preserved use the depreservation procedures given in paragraph E, Post Installation, checks, test and functions.

(7) The technique for connecting V-clamp type joints is:

(a) Lightly lubricate the V-clamp abutment and pipe flanges (refer to Materials).

(b) Install and connect pipe joint clamp and torque tighten to the specified value.

(c) Loosen the clamp one 1/2 turn.

(d) Retorque to the specified value.

(e) Repeat (c) and (d) until the clamp bolt ceases to advance.

**B. Connect slinging equipment and install engine mounts** *(Figures A410 and A411)*

(1) Connect the sling to the replacement engine.

**CAUTION: DO NOT LIFT ENGINE AND CASE.**

(2) Connect sling to hoisting equipment and take weight of the engine.

(3) Release engine/transportation case attachments.

(4) Raise the engine to working height then remove the transportation case.

*NOTE: Paragraphs (5) and (6) are not applicable if the replacement engine has been converted from a non-basic 125 engine (for example) TFE 731-3-1F*

(5) Left engine - Install the engine front mount top attachment assembly to the replacement engine.

*NOTE: The bottom attachment assembly is already on the replacement engine, torque loaded and wire-locked.*

(a) Make sure that the bushes at the socket-headed bolt holes are correctly seated.

(b) Locate the front mount top attachment assembly on the engine.

(c) Install the attachment assembly socket-headed bolts each side of the assembly.

(d) Torque tighten the bolts to 350-385 lbf in.

(e) Wire-lock the attachment bolts.

(6) Right engine - Install the engine front mount top and bottom attachment assemblies to the replacement engine:

(a) Make sure that the bushes at the socket-headed bolt holes are correctly seated.

(b) Locate the engine front mount top and bottom attachment assemblies on the engine.

(c) Install the socket-headed attachment bolts each side of the attachment assembly.

(d) Torque tighten the bolts to 350-385 lbf in.

(e) Wire-lock the attachment bolts.

*NOTE: The engine front mount bottom outboard assembly supplied with the engine is left 'in-situ'.*

*NOTE: At each vacant bush at the socket-headed bolt holes, thread one loop of locking wire through the bush and twist up wire round the engine flange.*

**C. Install engine** *(Figure A411)*

(1) Hoist the engine and carefully manoeuvre it toward the aircraft until the engine front top, and rear mounts align with their airframe counterparts.

(2) Connect the engine front mount top attachment assembly to the mounting yoke:

(a) Align the attachment assembly with the yoke fork, lightly lubricate the long and short bushes (refer to Materials). Insert the long bush from the rear and short bush from the front.

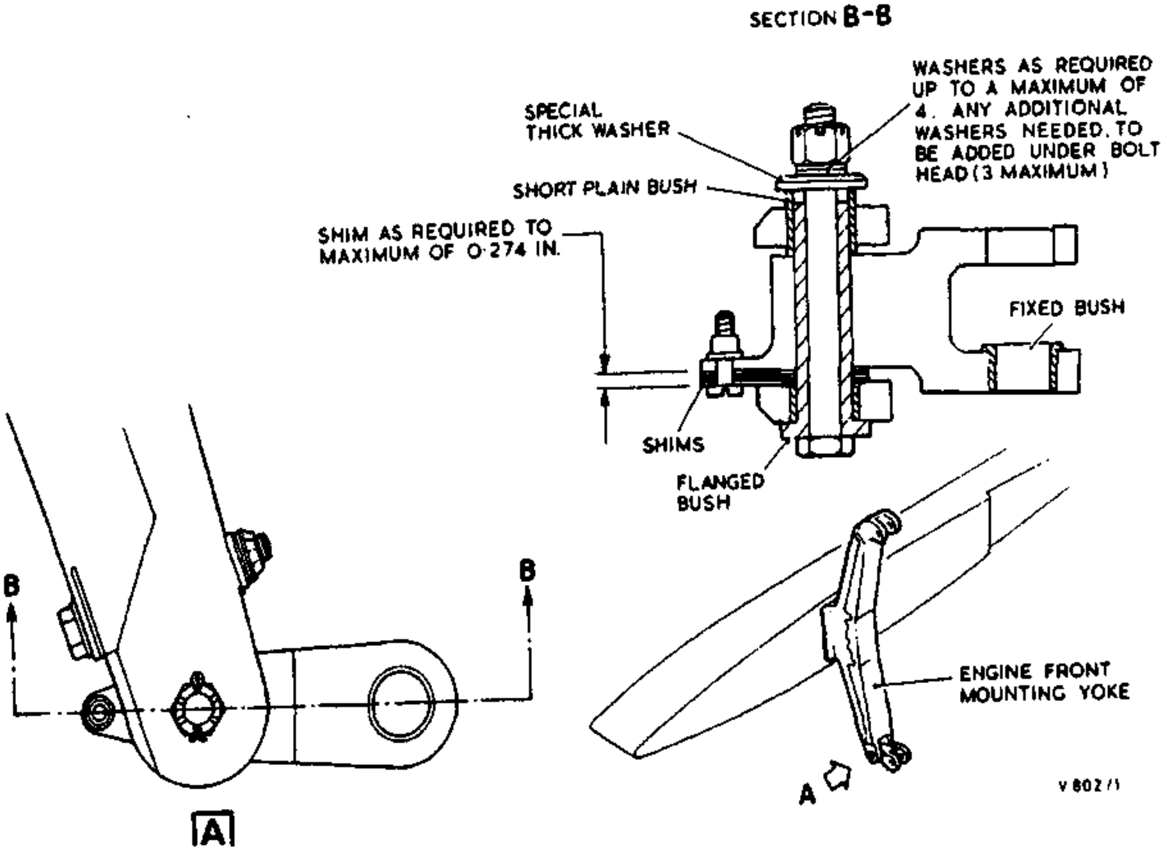
(b) Lubricate the attachment bolt, complete with special thick washer (refer to Materials), insert and push fully home.

(c) Install a special thick washer, plain washer and slotted nut in that order.

(d) Torque tighten the slotted nut to 160-190 lbf in. making sure that one slot in the nut aligns with the split pin hole in the bolt.

*NOTE: Should it be advantageous to apply tightening torque by way of the bolt, apply 185-215 lbf in. with the nut adequately restrained.*

(e) Install and lock a new split pin.


SECTION B-B
WASHERS AS REQUIRED UP TO A MAXIMUM OF 4. ANY ADDITIONAL WASHERS NEEDED, TO BE ADDED UNDER BOLT HEAD (3 MAXIMUM)
SPECIAL THICK WASHER
SHORT PLAIN BUSH
SHIM AS REQUIRED TO MAXIMUM OF 0·274 IN.
FIXED BUSH
SHIMS
FLANGED BUSH
B
B
ENGINE FRONT MOUNTING YOKE
A
V802/1
A

Yoke link shimming
*Figure A412*

(3) Connect the engine front bottom mount attachment assembly to the link:

(a) Rotate the link until its bolt hole aligns with the spherical bush in the bottom attachment assembly.

(b) Lubricate the long and short bushes (refer to Materials). Insert the long bush from the rear and short bush from the front.

(c) Apply Neverseez compound to engine rear attachment bolt (3) and attempt to insert complete with bonding strip and washers under the head.

NOTE: *Should the bolt be inserted easily continue at paragraph (5) and ignore paragraph (4).*

NOTE: *If difficulty is experienced in inserting the bolt adjust the link yoke shimming as detailed in paragraph (4).*

(4) As necessary - adjust link/yoke shimming *(Figure A412):*

**CAUTION: THIS ADJUSTMENT IS ONLY MADE WITH THE ENGINE SLING CONNECTED AND THE WEIGHT OF THE ENGINE TAKEN.**

(a) At the link/yoke attachment remove and discard split pin.

(b) Remove slotted nut, washers and special thick washer.

(c) Remove attachment bolt then extract flanged bush.

(d) Rotate the link sufficiently to disconnect and remove shims.

(e) Rotate the link back and insert flanged bush.

(f) Temporarily insert rear mount attachment bolt.

(g) Measure the shimming gap between link and yoke fork.

(h) Shim as required.

NOTE: *A maximum gap of 0.010 in. is permissible after shimming and before the attachment bolt is tightened.*

(i) Remove flanged bush, rotate link and secure the established thickness of shim to the link with the shim retaining screw head rearward. Install and tighten nut.

(j) Rotate link back to original position, insert flanged bush and bolt, install a special thick washer, plain washer/s and slotted nut. Check nut is not thread-bound.

(k) Torque tighten nut at 160-190 lbf in. making sure split pin hole aligns.

NOTE: *Should it be advantageous to apply tightening torque by the bolt, apply 185-215 lbf in. with the nut restrained.*

(l) Install and lock new split pin.

(5) Refer to *Figure A411* and lubricate the bolt (2) (refer to Materials) and insert bolt complete with washer under the head.

(6) Install a special thick washer and plain washer (as from bolt removal) and slotted nut. Make sure the nut is not thread-bound.

(7) Torque tighten the slotted nut to 160-190 lbf in. making sure the split pin hole aligns.

*NOTE: Should-it be advantageous to apply tightening torque by the bolt, apply 185-215 lbf in. with the nut restrained.*

(8) Install and lock a new split pin.

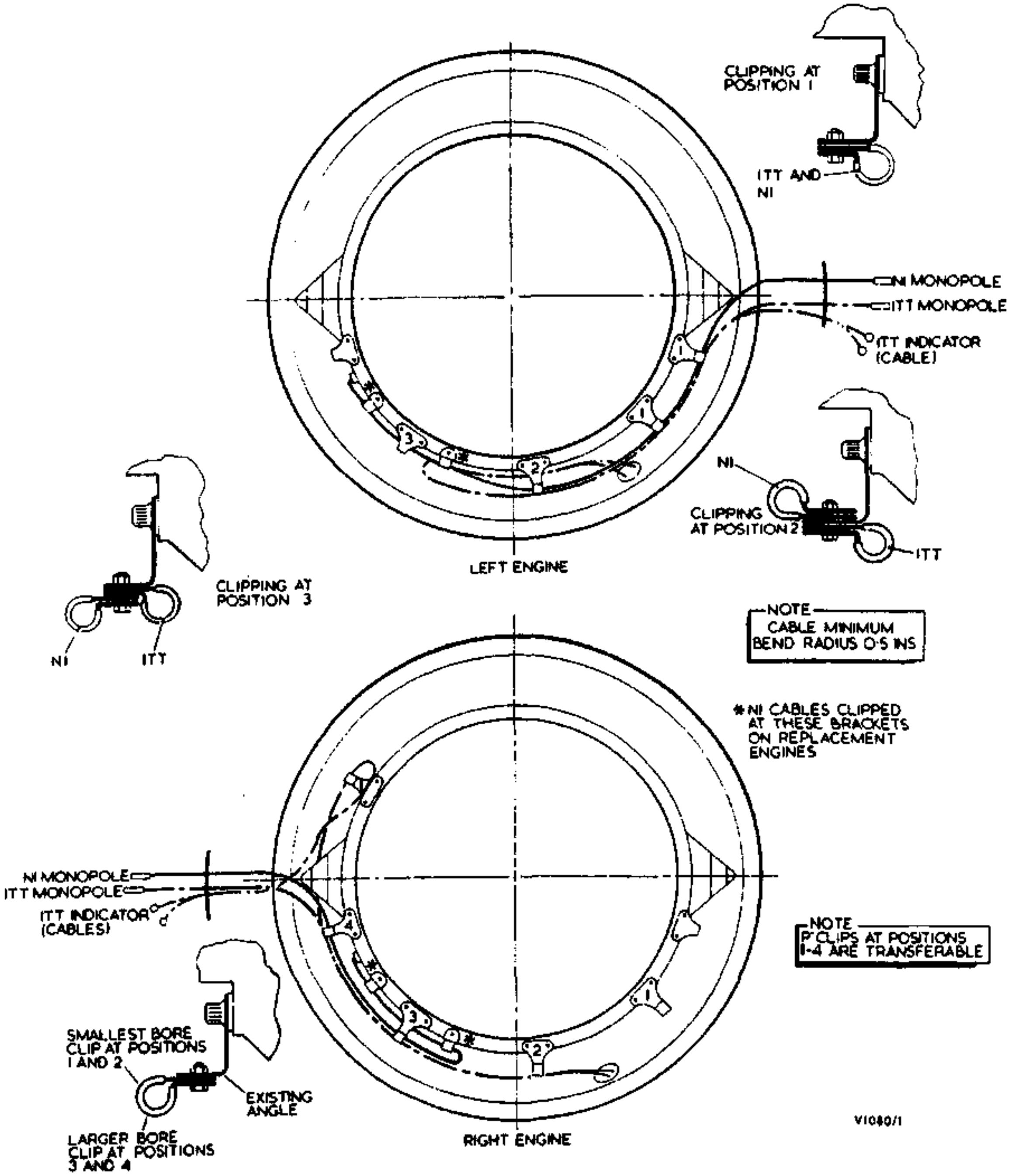
(9) Connect the engine rear mount attachment:

(a) Install plain washer/s (as from removal) and slotted nut.

(b) Torque tighten the nut to 60-85 lbf in. making sure that one slot in the nut aligns with the split pin hole in the bolt. Make sure that there is not less than 0.015 in. clearance between the threaded end of the bolt and the engine casing. Should the minimum clearance not be achieved transfer a plain washer from under the nut to under the bolt head.

(c) Install and lock a new split pin.

(10) Disconnect and remove engine sling.



Clipping of N1 and ITT services
*Figure A413*

**D. Installation of components and connection of services** *(Figures A402, A408 and A413)*

(1) Connect and clip up N1 and ITT services:

(a) At the engine rear mount seal, install the lower panel assembly by connecting it to the engine attachment flange; use bolts 10-14 and 19 (left engine) or bolts 37 and 42-46 (right engine). Do not torque tighten attachment bolts at this stage.

(b) Connect the ITT indicator cable red sleeve indented lead to terminal LY2 of terminal block LY (left engine) and the yellow sleeved lead terminal LY1 or the red sleeved lead to terminal MY2 of terminal block MY (right engine) and the yellow sleeved lead to terminal MY1 i.e., engine red sleeved lead to aircraft blue sleeved lead and engine yellow sleeved lead to aircraft red sleeved lead.

*NOTE: If the engine installed does not incorporate a shortened ITT cable, refer to Chapter 77-21-00 - SERVICING - for the method of shortening the cable if adequate facilities exist at the location of the engine change. If such facilities do not exist, connect up at the terminal block, tape up surplus cable into a coil, make sure that it is clear of hot parts and defer cable shortening until return to base. Mod.252657 only, it will be necessary to pass the cable through a hole in the fairlead before connecting up.*

(c) Pre-Mod.252657 only. Install fairleads.

(d) Connect the N1 monopole coded TV1 (left engine) or TW1 (right engine).

(e) Connect the ITT computer plug, coded TV2 (left engine) or TW2 (right engine).

(f) Install terminal block cover and terminal cover.

(g) Lay the cables/leads across the rear cut-out in the lower panel assembly.

(h) Pull the cables/leads straight leaving sufficient slack to allow clipping at the engine *(Figure A413)* and assembly of seals and plates at the engine rear mount fairing.

(i) Clip the cables/leads using the P-clips, bolts, washers and stiffnuts obtained at engine removal.

**CAUTION: MINIMUM BEND RADIUS OF CABLES TO BE NOT LESS THAN 0.50 IN.**

(2) Install and clip up fire detection system detector and sensor *(Figure A414)*:

*NOTE: Refer to Table A402 for details of brackets, clamps and bushes to be transferred from removed engine.*

(a) Carefully thread the sensor from its blank end under the engine piping and behind oil tank.

**CAUTION: AVOID KINKING THE SENSOR DURING ROUTING TO ITS FINAL LAY. BENDS IN THE SENSOR DUE TO ITS ROUTING MUST BE NOT LESS THAN 0.50 IN**

(b) Carefully thread the sensor through the distance tube in the lower panel assembly, passing sufficient through the tube to reach the rear end of the engine.

(c) Open up clamp at position 1, install a slotted bush to the sensor and lay the bush in the clamp. Close and screw up the clamp with the blank end of the sensor located as shown.

(d) Install slotted bushes and clamp up at positions 2-9.

(e) At the lower panel assembly install a slotted bush to the sensor so that it lays across the forward slot in the lower panel assembly as shown. At the distance tube carefully insert a flanged slotted bush from each end as shown.

(f) Left engine only - Install brackets with clamps at positions 10-11-12, install slotted bushes and lay bushes in clamps. Screw up the clamps.

Table A402
FIRE DETECTION SYSTEM SENSOR AND DETECTOR
ATTACHMENT AND TRANSFER DETAILS

| ATTACHMENTS 1 - 9 |
|---|
| Mounting bracket complete with clamp supplied already on replacement engine and torque loaded - bush transferred from time expired/ unserviceable engine. |
| ATTACHMENTS 10 (left engine), 11, 19 |
| Mounting bracket (complete with clamp), bush, bolt and nut all transferred. |
| ATTACHMENTS 10 (right engine) |
| Mounting bracket (complete with clamp), bush and two washers all transferred. |
| ATTACHMENTS 12-18; 21 |
| Mounting bracket (complete with clamp) and bush transferred. |
| ATTACHMENT 20 |
| Mounting bracket (complete with clamp) and washers transferred. |
| DETECTOR |
| Left engine - mounting bracket complete with DETECTOR, two washers and attachment bolt/nut all transferred.<br>Right engine - mounting bracket complete with DETECTOR, and attachment bolt/nut transferred. |

*NOTE: For attachments 13, 14, the bracket retaining bolts are part of the inlet cowl/engine attachment.*

*NOTE: For attachments 10 (right engine), 12, 13, 16-18, 20, mounting brackets are attached using a bolt or stud which is part of the basic engine.*

(g) Right engine only - Install bracket with clamp at position 10, remove nut from fuel heater attachment, install two washers and bracket with clamp. Install fuel heater attachment nut and torque tighten to 65-75 lbf in. Install slotted bush to sensor, lay bush in clamp, close and tighten clamp.

(h) Right engine only - At position 11 install slotted bush to sensor and close bracket mounted clamp.

*NOTE: Connect bracket to the engine as described in "Install low pressure air piping", (paragraphs (3) and (4) following). At position 12, install slotted bush to sensor, lay bush in clamp and close clamp. Connect clamp to bracket.*

(i) Brackets at positions 13-15 Install during installation of inlet cowl.

(j) At position 16, remove two nuts from accessaries gearbox, install bracket with clamp and torque tighten nuts to 55-65 lbf in. Install slotted bush to sensor, lay bush in clamp. Close and tighten clamp.

(k) At positions 17-18 remove two engine nuts, install bracket with clamp and torque tighten nuts to 65-75 lbf in.

(l) At position 19, install bracket with clamp, install slotted bush to sensor, lay bush in clamp and close and tighten clamp.

(m) At position 20, remove attachment nut from fuel heater, install two washers and bracket with clamp. Torque tighten attachment nut to 65-75 lbf in. Install slotted bush to sensor, lay bush in clamp. Close and tighten clamp.

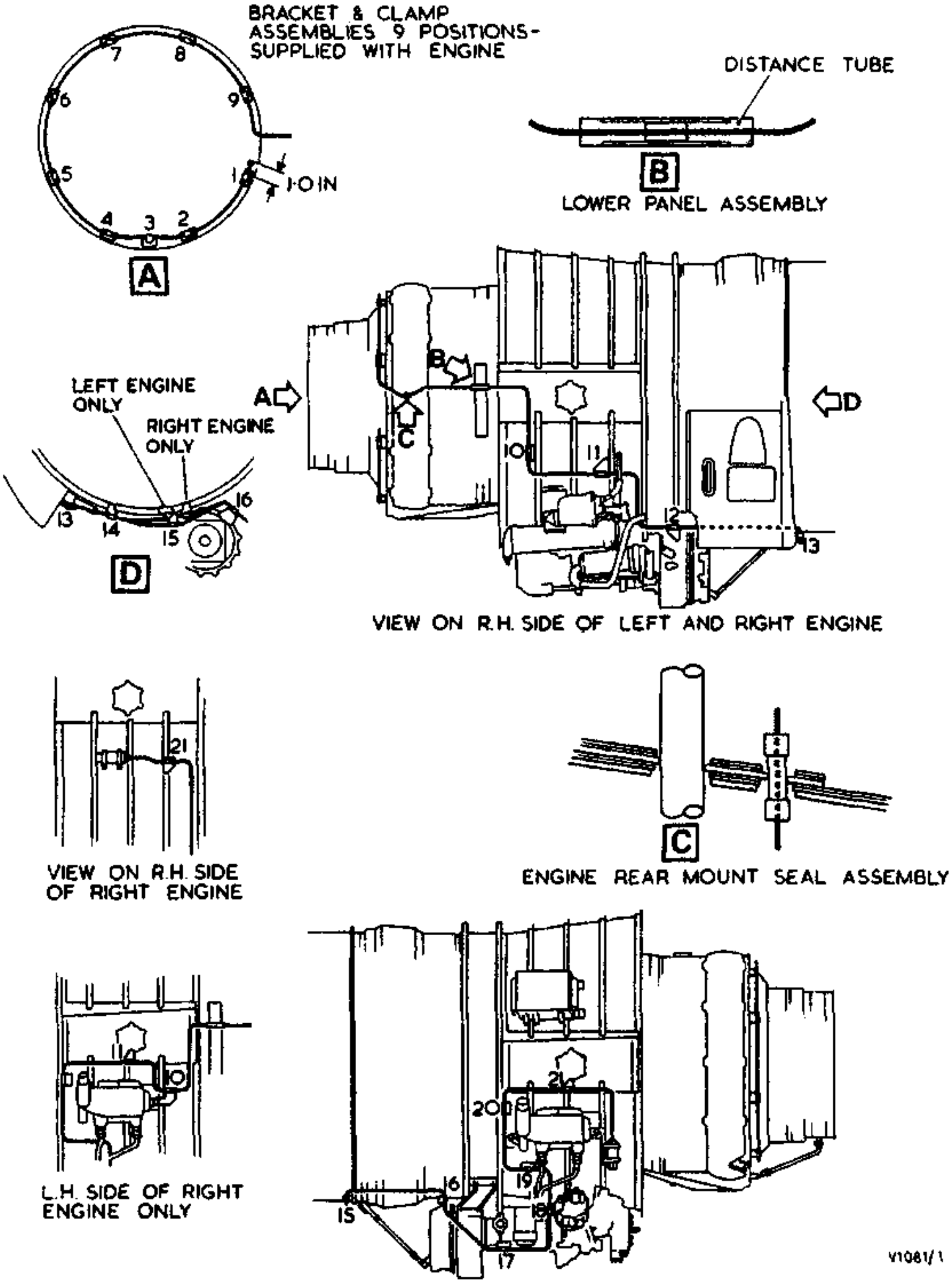
(n) Left engine only - Position 21: Install slotted bush to sensor, lay bush in clamp. Close and tighten clamp.

*NOTE: Connect bracket to the engine as described in "Install low pressure air piping" (paragraphs (3) and (4) following).*

(o) Right engine only - Position 21: Install bracket, install slotted bush to sensor, lay bush in clamp. Close and tighten clamp.

(p) Left engine only - Detector: Remove attachment nut from fuel heater, install two washers and mounting bracket. Connect bracket to engine casing. Torque tighten attachment nut to 65-75 lbf in.

(q) Right engine only - Detector: Connect bracket to engine casing.


BRACKET & CLAMP ASSEMBLIES 9 POSITIONS-SUPPLIED WITH ENGINE
1
2
3
4
5
6
7
8
9
1·0 IN
A
DISTANCE TUBE
B
LOWER PANEL ASSEMBLY
LEFT ENGINE ONLY
RIGHT ENGINE ONLY
13
14
15
16
D
A
B
C
D
10
11
12
13
VIEW ON R.H. SIDE OF LEFT AND RIGHT ENGINE
21
VIEW ON R.H. SIDE OF RIGHT ENGINE
C
ENGINE REAR MOUNT SEAL ASSEMBLY
11
L.H. SIDE OF RIGHT ENGINE ONLY
21
20
19
18
17
16
15
V1081/1
VIEW ON L.H. SIDE OF LEFT AND RIGHT ENGINE

Layout of fire detection system
*Figure A414*

(3) Left engine: - Install low pressure air piping:

(a) At the low pressure air supply tapping (rudder bias) on the left side of the engine, unbolt and remove the tapping sealing plate and gasket. Discard the gasket.

(b) Install a new gasket to the tapping, lay the piping assembly complete with mounting brackets across the engine and align the piping assembly attachment plate with the tapping.

(c) Bolt fire detection system sensor attachment bracket No.21 to one lowermost hole then install bolts to the four remaining upper holes. Do not torque tighten the bolts at this stage.

*NOTE: The remaining bolt hole accepts the P-clip No.7 when the TA1 harness is installed.*

(d) Bolt up the four piping assembly attachment brackets.

(e) At the low pressure air supply tapping (air conditioning system mixer valve) on the right side of the engine, unbolt and remove the sealing plate and gasket. Discard the gasket.

(f) Install a new gasket to the tapping then install low pressure air supply connector using the bolts from the removed engine. Torque tighten the bolts to 25-30 lbf in.

(4) Right engine - Install low pressure air piping:

(a) At the low pressure air supply tapping (rudder bias) on the rightside of the engine unbolt and remove the sealing plate and gasket. Discard the gasket.

(b) Install a new gasket to the tapping, lay the piping assembly across the engine and align the piping assembly attachment plate with the tapping.

(c) Bolt up the piping assembly attachment plate using the bolts from the removed engine. Torque tighten the bolts to 25-30 lbf in.

(d) Bolt up the four piping assembly attachment brackets.

(e) At the low pressure air supply tapping (air conditioning system mixer valve) on the left side of the engine, unbolt and remove the sealing plate and gasket. Discard the gasket.

(f) Install a new gasket to the tapping to install the low pressure air supply connector using the bolts from the removed engine. Before installing the lowermost bolt, attach fire detection system sensor attachment bracket No.12. Torque tighten the bolts to 25-30 lbf in.

(5) Install high pressure air bleed piping *(Figure A409)*:

(a) Insert pipe through aperture in engine upper casing with its bolt-up joint aft.

(b) Slide seal housing on to pipe and insert new seal into housing.

(c) Locate the spacer plates, lay the seal housing complete with seal on the spacer plates, locate the split retainers and slotted retainer in that order as shown. Locate the TA1 harness (left engine) or TB1 harness (right engine) attachment bracket and bolt up using washers under the two forward nuts only. Install all four silver-plated nuts.

(d) Torque tighten the nuts to 20 lbf in. gradually increasing the torque until new split pins can be inserted.

(e) Move the pipe laterally to check freedom of seal housing.

(f) Install and lock new split pins.

(6) Install high pressure air (H.P.) supply pipe:

(a) Remove cap from H.P. pipe in pylon.

(b) Remove cap and gasket from H.P. air supply aperture on engine. Discard gasket.

(c) Install a new Lo-Load seal to the pipe flange, maneuver pipe on to the engine and locate in supply aperture. Install washers to bolts and screw in the bolts. Torque tighten bolts to 25-30 lbf in. and wire-lock bolt heads.

(d) Connect pipe-mounted bracket to engine using two bolts (washers under their heads), spacers, washers and silver-plated nuts.

(e) At the steady pipe/H.P. pipe joint, insert a new Lo-Load seal then connect up using bolts, washers and silver-plated nuts. Torque tighten nuts to 20 lbf in. gradually increasing torque until new split pins can be inserted. Lock the split pins.

(7) Install inlet shut-off valve complete with input piping:

(a) Position the pipe and valve and temporarily attach to inlet cowl attachment flange.

(b) At the connection to the steady pipe, lubricate the pipe flanges and attachment clamp abutment faces (refer to Materials).

(c) Install and finger tighten the clamp, make sure that the clamp tightening bolt is clear of the engine upper cowl.

(d) Torque tighten the clamp to 35-45 lbf in.

(e) Connect adjacent pipe mounted bracket to flange on engine casing with bolt heads forward and a washer under each silver-plated nut.

*NOTE: Connect the two remaining pipe clips to the engine after the inlet cowl has been installed.*

(8) Install accessories at fuel-charged oil cooler:

(a) Remove existing adapter and jumper tube from oil cooler fuel inlet.

(b) Disconnect outlet adapter from fuel flow transmitter.

(c) Install a new O-ring seal to the adapter, screw adapter into oil cooler, tighten and wirelock.

(d) At the oil pump remove the cap.

(e) Remove cap from oil pipe on the mounting bracket assembly.

(f) Install mounting bracket complete with oil low pressure switch, oil pressure transmitter and oil pipe using the bolts and nuts (4 off) attached thereto.

(g) Connect oil pipe, tighten and wire-lock.

(h) Connect fuel flow transmitter to adapter at oil cooler inlet. Make sure that the flow direction arrow on the transmitter points towards the oil cooler then tighten the transmitter attachment nut. Wire-lock the nut.

(i) Remove cap from fuel flow transmitter inlet adapter.

(j) Remove cap from fuel inlet pipe, connect pipe, tighten and wire-lock.

(k) Adjacent to the oil pipe connection remove cap closing the oil temperature bulb housing.

(l) Remove cap from oil temperature bulb.

(m) Install a new O-ring seal to the temperature bulb, screw bulb into housing, tighten and wirelock.

NOTE: *Connect electrical supplies to these components after installation of TA1 harness (left engine) or TB1 harness (right engine).*

(n) Remove cap from fuel high temperature switch aperture on engine and switch. Install a new O-ring seal to the switch mounting. Screw in and tighten the switch.

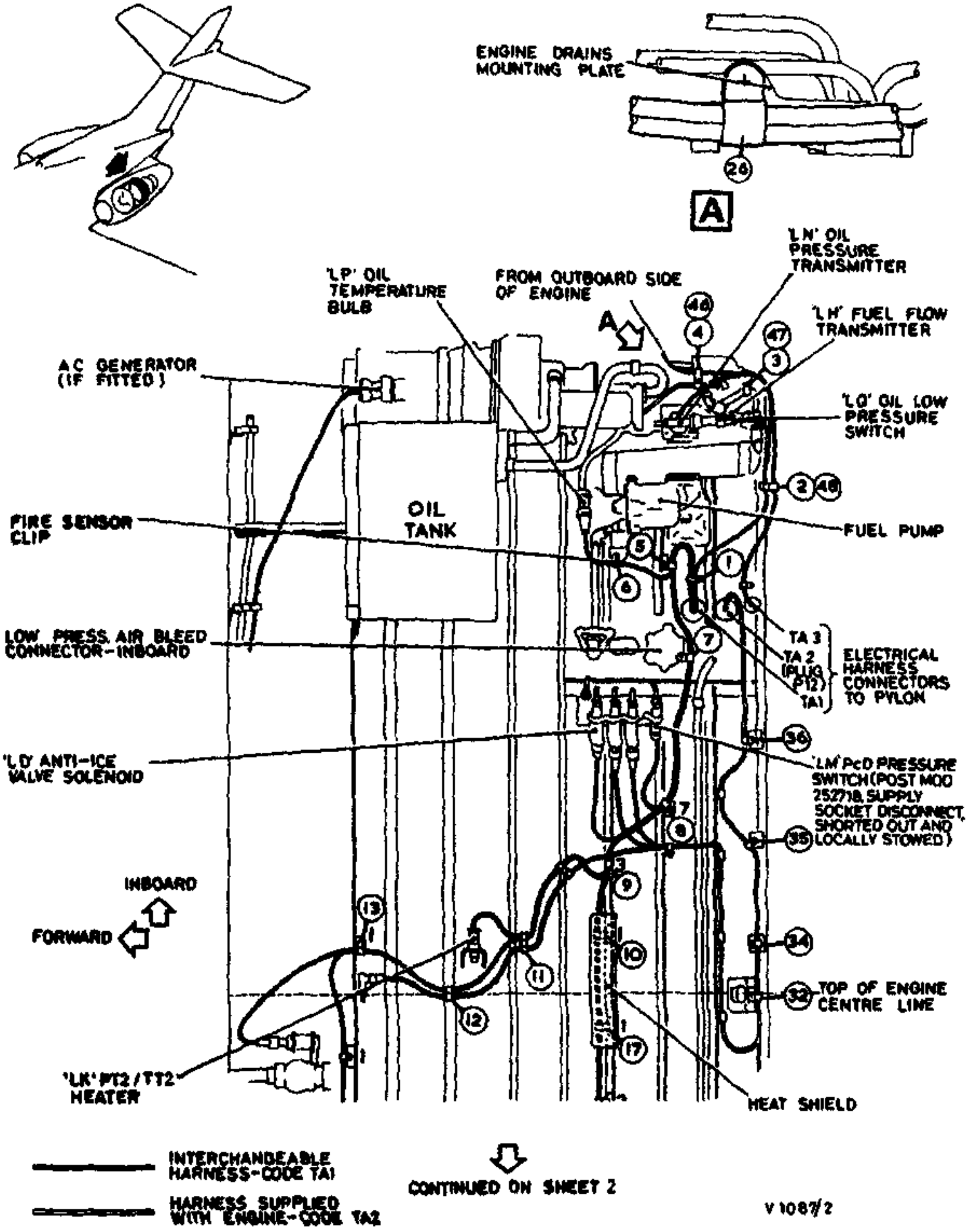
NOTE: *Connect the jiffy connector, on the switch flying leads, when clip No.26 (left engine) or 25 (right engine) is attached during installation of witness drains assembly.*

(9) Left engine - Install TA1 harness *(Figure A415 Sheets 1 and 2)*:

NOTE: *The following sequence of operations installs the harness to the extent of fixing most of the retention clipping and electrical reconnections, the remaining clipping and electrical connections are made during the later stages of the build up to power plant standard. The numbers in circles on Figure A415 refer to clip numbers which with their locations and assembly parts, are listed to Table A403.*

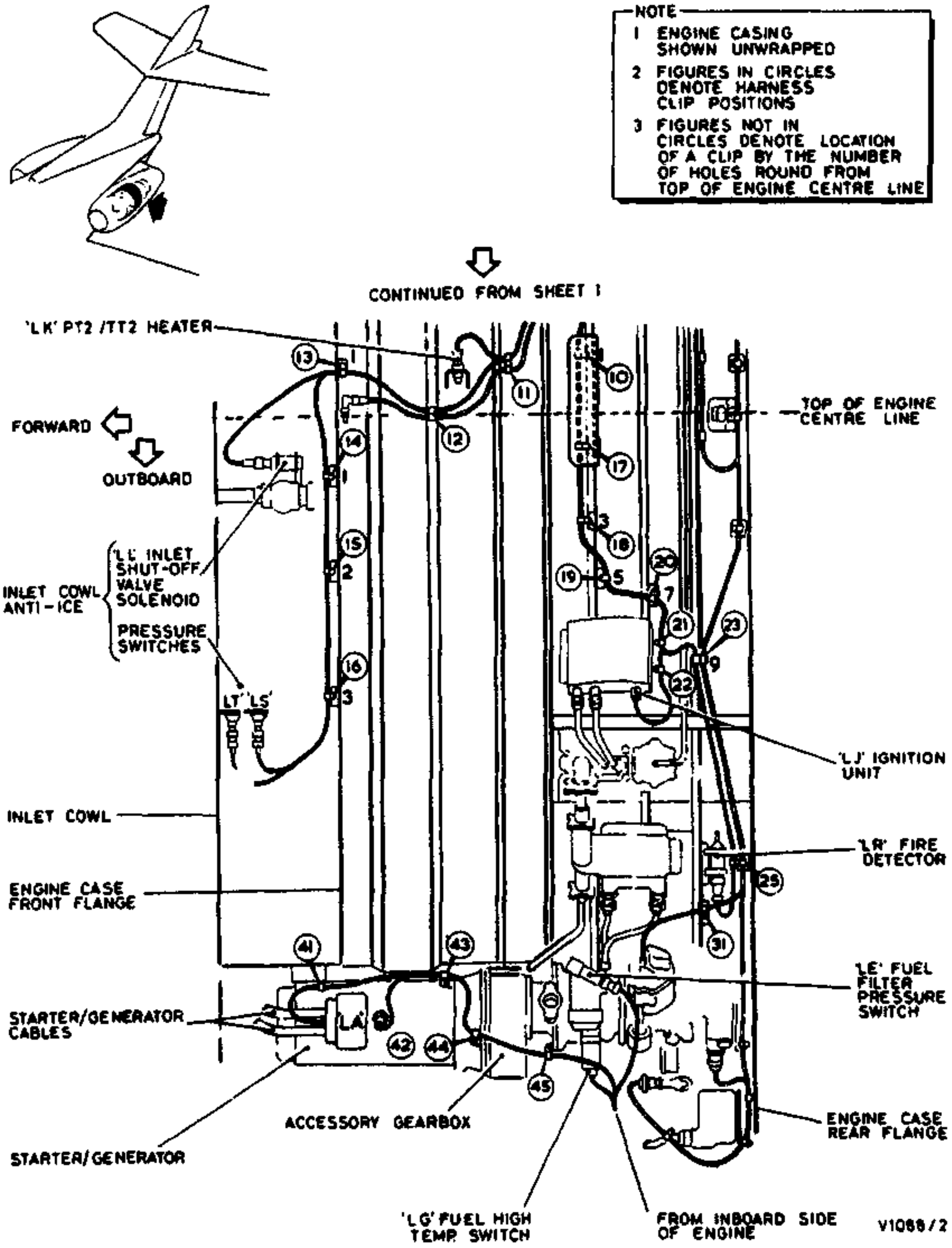
NOTE: *To facilitate correct assembly of harness connector ends to their associated components, the ends are identified as follows:*

| End | Ident | Code |
|---|---|---|
| A | PYLON INTERFACE | TA1-M1 |
| B | PcD PRESS SWITCH (Pre-Mod.252718 only) | LM |
| C | ANTI-ICE VALVE SOLD | LD |
| D | PT2-TT2 HEATER | LK |
| E | INLET SHUT-OFF VALVE | LL |
| F | INLET ANTI-ICE PRESS (FLT) | LS |
| G | FIRE DETECTOR | LR |
| H | IGNITION UNIT | LJ |
| J | OIL LOW PRESS | LQ |
| K | FUEL FILTER PRESS SW | LE |
| L | FUEL HIGH TEMP | LG |
| M | FUEL FLOW TRANR | LH |
| N | OIL PRESS TRANR | LN |
| P | OIL TEMP | LP |
| Q | INLET ANTI-ICE PRESS (GND) | LT |


ENGINE DRAINS MOUNTING PLATE
26
A
'LN' OIL PRESSURE TRANSMITTER
'LP' OIL TEMPERATURE BULB
FROM OUTBOARD SIDE OF ENGINE
A
46
4
47
3
'LH' FUEL FLOW TRANSMITTER
A C GENERATOR (IF FITTED)
'LQ' OIL LOW PRESSURE SWITCH
2
48
OIL TANK
FIRE SENSOR CLIP
FUEL PUMP
5
6
1
TA 3
TA 2 (PLUG P12)
TA1
ELECTRICAL HARNESS CONNECTORS TO PYLON
LOW PRESS. AIR BLEED CONNECTOR-INBOARD
7
'LD' ANTI-ICE VALVE SOLENOID
36
'LM' PcD PRESSURE SWITCH (POST MOD 252718, SUPPLY SOCKET DISCONNECT, SHORTED OUT AND LOCALLY STOWED)
7
8
35
3
9
INBOARD
FORWARD
13
16
11
10
34
32
TOP OF ENGINE CENTRE LINE
12
17
'LK' PT2 / TT2 HEATER
HEAT SHIELD
INTERCHANGEABLE HARNESS-CODE TA1
HARNESS SUPPLIED WITH ENGINE-CODE TA2
CONTINUED ON SHEET 2
V 1087/2

Installation of electrical harness TA1/TA3

*Figure A415 (Sheet 1 of 2 - left engine)*



NOTE
1 ENGINE CASING SHOWN UNWRAPPED
2 FIGURES IN CIRCLES DENOTE HARNESS CLIP POSITIONS
3 FIGURES NOT IN CIRCLES DENOTE LOCATION OF A CLIP BY THE NUMBER OF HOLES ROUND FROM TOP OF ENGINE CENTRE LINE

Installation of electrical harness TA1/TA3

*Figure A415 (Sheet 2 of 2 - left engine)*

(a) Lay the harness across the engine upper casing and connect end A to plug M1 at the pylon interface and wire-lock.

(b) Connect and tighten clip No.1 to existing bracket on engine casing.

*NOTE: Connect clip No.2 when the aft cowl assembly is installed and connect clips No.3, and 4 when TA3 harness is installed.*

Table A403
Left engine - TA1 harness attachments - location, clipping and transfer details.

| Clip No. | Location | Transfer |
|---|---|---|
| 1 | Near TA1 plug break | Angle, P-clip, bolt, washer and stiffnut. Picks up on existing fire detection system sensor wire attachment angle. |
| 2 | Aft cowl attachment flange | 2 P-clips, bolt, washer and stiffnut. Also locates TA3 harness. |
| 3 | Fuel flow transmitter input pipe | 2 P-clips, bolt, washer and stiffnut. Also locates TA3 harness. |
| 4 | Oil pipe | 2 P-clips, bolt, washer, and stiffnut. Also locates TA3 harness. |
| 5 | Between plug break and oil temperature bulb | 2 P-clip, bolt, washer, and stiffnut. Picks up with existing bracket on engine casing. |
| 6 | Adjacent to oil temperature bulb | P-clip, bolt, washer, and stiffnut. Connects with existing bracket on engine casing. |
| 7 | Low pressure air tapping (rudder bias) | P-clip. Connects with existing bolt at air tapping attachment. |
| 8 | Adjacent to anti-ice solenoid valve, code LD | P-clip, bolt, washer, and stiffnut. Connects with existing bracket on engine casing. |
| 9 | Between heat shield and anti-ice valve solenoid code LD | P-clip, bolt, washer, and stiffnut. Picks up with existing bracket on engine casing. |
| 10 | Under heat shield | P-clip, bolt, washer, and stiffnut. Connects with existing bracket on engine casing. |
| 11-12 | Adjacent to PT2 heater | P-clip. Picks up with existing P-clip bolt for TA2 harness. |
| 13-16 | Inlet cowl attachment flange | P-clip, bolt, washer, and stiffnut. Connects with existing bracket on engine casing. |

| Clip No. | Location | Transfer |
|---|---|---|
| 17 | Under heat shield | P-clip, bolt, washer, and stiffnut. Connects with existing bracket on engine casing. |
| 18-20 | Engine casing | P-clip, bolt, washer and stiffnut. Picks up with existing bracket. |
| 21-22 | Ignition unit | P-clip. Picks up with two of the ignition unit attachment bolts. |
| 23 | Near rudder bias pipe | P-clip. Locates TA1 and TA2 harness. |
| 24 | Not used | – |
| 25 | Fire detection system detector | P-clip. Connects as for clip 24. |
| 26 | Witness drains assembly | P-clip. Connects with witness drains support bracket attachment to engine bolt. |
| 27 | – | P-clip, picks up with TA2 harness bracket between clips 9 and 11. |

(c) Connect and tighten clip No.5 to existing bracket on engine casing.

(d) Connect and tighten clip No.6 to space hole in fire detection system sensor attachment bracket.

(e) Connect harness ends J, M, N, P to the oil low pressure switch, fuel flow transmitter, oil pressure transmitter and oil temperature bulb respectively.

(f) Using the remaining bolt at the low pressure air tapping (mixer valve connector) attach clip No.7. Torque tighten all six bolts to 25-30 lbf in.

(g) Connect and tighten clips No.8, 9, 10 to existing brackets on engine casing.

(h) Connect harness ends B (Pre-Mod.252718), C, D to the PcD pressure switch (Pre-Mod.252718), anti-ice valve solenoid and PT2/TT2 heater.

(i) Remove nut and washer from TA2 harness at clip positions 11, 12. Connect P-clips No.11 and 12 to existing bolts, install washers and tighten nuts.

*NOTE: Connect Clips No.13-16 when the inlet cowl is installed.*

(j) Connect and tighten clip No.17 to existing bracket on engine casing.

(k) Install and bolt up heat shield to cover clips No.10 and 17.

(l) Connect and tighten clips No.18-20 to existing brackets on engine casing.

(m) Remove ignition unit rear attachments, connect clips No.21, 22, re-install attachments and tighten.

(n) Connect harness end H to the ignition unit LT socket.

(o) At clip position No.24 disconnect and discard the P-clip and bolt. Pass TA1 harness end G under low pressure air pipe (rudder bias). Install clip No.23 to include TA1 and TA2 harnesses, connect and tighten P-clip No.23 to existing bracket on engine casing. Arrange clip to give adequate clearance between harnesses and pipe.

Table A404
Left engine - TA2 harness attachment - location, clipping and transfer details.

| Clip No. | Location | Transfer |
|---|---|---|
| 31 | Fire detection system | P-clip, bolt, washer and stiffnut. Connects with existing bracket on engine casing. |
| 32 | Anti-icing pipe | P-clip, bolt and washer. Connects with existing bracket on engine casing. |
| 33-36 | Aft cowl attachment flange | P-clip, bolt, washer and stiffnut. Connects with existing bracket on engine casing. |

(p) At clip position 25 remove nut and washer from each clip locating TA2 harness. Install TA1 harness P-clips, washers and nuts to existing bolts and tighten down.

(q) Connect harness end G to fire detection system detector.

*NOTE: Connect Clip No.26, when the witness drains assembly is installed. The jiffy connector (fuel high temp) is also connected to harness end L.*

(r) Connect harness end K to fuel filter pressure switch.

*NOTE: Connect Harness ends E, F, Q when the inlet cowl has been installed.*

(s) At clip No.27 remove the bolt and clip securing TA2 harness. Connect TA1 harness. Install and tighten bolt.

(10) Left engine - Connect and clip up harness TA2 *(Figure A415)*:

*NOTE: The numbers in circles on Figure A415 refer to clip numbers which, with their locations and assembly parts, are listed in Table A404.*

(a) Connect and tighten clip No.31 to existing bracket on engine casing.

(b) Connect clip No.32, to existing bracket on engine casing, at anti- icing pipe.

(c) Connect and tighten transfer clips No.32-36 to existing brackets on engine casing.

(d) Connect harness plug P12 to its counterpart at the pylon interface torque tighten to 120-130 lb in. using the appropriate strap wrench (refer to Equipment required) and wirelock.

(11) Left engine - Install harness TA3 *(Figure A415)*:

*NOTE: The numbers in circles on Figure A415 refer to clip numbers, and their assembly parts are listed in Table A405.*

(a) Connect TA3 harness end A, coded TA3-M1, to its counterpart at the pylon interface and wire-lock.

(b) Connect and tighten clip No.49 to existing bracket on engine casing.

*NOTE: Connect clip No.48 with clip No.2 for TA1 harness when the aft cowl is installed.*

(c) Connect clips No.47 and 3, 46 and 4 to the forward and aft pipes, respectively.

*NOTE: Connect Clips No.45-41 when the starter/generator is installed.*

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Table A405

Left engine - TA3 harness attachments - location, clipping and transfer details.

| Clip No. | Location | Transfer |
|---|---|---|
| 41 | Starter/generator | P-clip. Connects with existing cables clamp bolt. |
| 42 | Hydraulic pump | P-clip, bolt, washer and stiffnut. Clips to pump suction pipe. |
| 43 | Hydraulic pump | Angle, P-clip, bolt, washer and stiffnut. Angle seated under pump bottom outboard mounting nut. |
| 44-45 | Accessories gearbox | Angle, P-clip, bolt, washer and stiffnut. Angle connected to fitting on gearbox. |
| 46-48 | See clip No.4, 3, 2 - Table A403 | Also locates TA1 harness. |
| 49 | Plug break | P-clip, bolt and washer. Connects with existing trap nutted bracket on engine casing. |

(12) Right engine - Install TB1 harness *(Figure A416):*

*NOTE: The following sequence of operations installs the harness to the extent of fixing most of the retention clipping and electrical connections, the remaining clipping and electrical connections are made during the latter stages of the build up to power plant standard. The numbers in circles on Figure A416 refer to clip numbers which, with their locations and assembly parts, are listed in Table A406.*

To facilitate correct assembly of harness connector ends to their associated components, the ends are identified as follows:

| End | Ident | Code |
|---|---|---|
| A | PYLON INTERFACE | TB1-M2 |
| B | IGNITION UNIT | MJ |
| C | PT2-TT2 HEATER | MK |
| D | INLET ANTI-ICE PRESS (FLT) | MS |
| E | INLET SHUT-OFF VALVE | ML |
| F | OIL TEMP | MP |
| G | OIL LOW PRESS | MQ |
| H | FUEL HIGH TEMP | MG |
| J | FUEL FILTER PRESS SW | ME |
| K | OIL PRESS TRANR | MN |
| L | FUEL FLOW TRANR | MH |
| M | FIRE DETECTOR | MR |
| N | PcD PRESS SW (Pre-Mod.252718 only) | MM |
| P | ANTI-ICE VALVE SOLD | MD |
| Q | INLET ANTI-ICE PRESS (GND) | MT |

(a) Lay the harness across the engine upper casing and connect end A to its counterpart at the pylon interface and wire-lock.

(b) Remove 1st and 4th engine bolts (working aft from the engine main mounting ring) and connect angles of clips No.1, 2 to the bolts. Install bolts and torque tighten to 40-44 lbf in.

(c) Connect harness end B to the ignition unit LT socket.

Table A406
Right engine - TB1 harness attachments - location, clipping and transfer details.

| Clip No. | Location | Transfer |
|---|---|---|
| 1-2 | Near ignition unit | Angle, P-clip, bolt washer and stiffnut. Connects with existing bracket on engine casing. |
| 3-4 | Ignition unit | P-clip, bolt, washer and stiffnut. Connects with existing bracket on engine casing. |
| 6 | Under heat shield | P-clip, bolt, washer and stiffnut. Connects with existing bracket on engine casing. |
| 7 | Adjacent to anti-ice valve solenoid, code MD | Distance piece, 2 P-clips, bolt, washers and stiffnut. Connects with existing angle on engine casing, also locates TB2 harness. |
| 8 | Adjacent to anti-ice valve solenoid, code MD | P-clip, bolt, washer and stiffnut. Connects with existing bracket on engine casing. |
| 9-10 | Adjacent to low pressure air tapping (rudder bias) | Angle, clip 10, P-clip, bolt, washer and stiffnut. Connects with existing bracket on engine casing. |
| 11-12 | Fire detection system detector | P-clip, bolt and washer, stiffnut. Connects with existing brackets on engine casing. |
| 13 | At fuel charged oil cooler | P-clip, bolt, washer and stiffnut. Picks up on existing bracket on engine casing. |
| 14 | Fuel flow transmitter input pipe | 2 P-clips, bolt, washer and stiffnut. Clamps to input pipe. |
| 15 | Oil pipe | 2 P-clips, bolt, washer and stiffnut. Clamps to oil pipe. |
| 16-18 | Adjacent to PT2/TT2 heater | P-clip. Connects with existing TB2 harness clip attachment bolt. |

| Clip No. | Location | Transfer |
|---|---|---|
| 19-20 | Inlet cowl attachment flange | P-clip, bolt, washer and stiffnut. Picks up with existing brackets on engine casing. |
| 21-22 | Inter cowl attachment flange | P-clip. Picks up with existing bolts. |
| 23 | Fire detection system detector | P-clip, bolt, washer and stiffnut. Picks up with detector attachment. |
| 24 | Oil temperature bulb | P-clip, bolt, washer and stiffnut. Picks up on fire detection system sensor attachment bracket. |
| 25 | Witness drains assembly | P-clip. Connect with witness drains support bracket attachment to engine. |
| 26 | Witness drains assembly | 2 P-clips, bolt, washer and stiffnut. Connects to fuel control unit drain pipe. |

(d) Remove the ignition unit forward attachments, install clips No.3, 4, reconnect and tighten attachments.

(e) Connect and tighten clips No.5 and 6, to existing brackets on engine casing.

(f) Install heat shield centrally disposed across engine C/L to cover clip No.6.

(g) At clip position No.7 remove nut and washer from TB2 harness clip, connect clip No.7 to existing bolt, install washer and nut then tighten.

(h) Pass harness under low pressure air pipe (rudder bias), connect and tighten clips No.8 and 9. Arrange clip No.9 to give adequate clearance between harness and pipe.

(i) At clip position No.10, (working aft from the engine main mounting ring) remove 9th engine bolt. Connect angle of clip No.10 to removed bolt, install bolt and torque tighten to 40-44 lbf in.

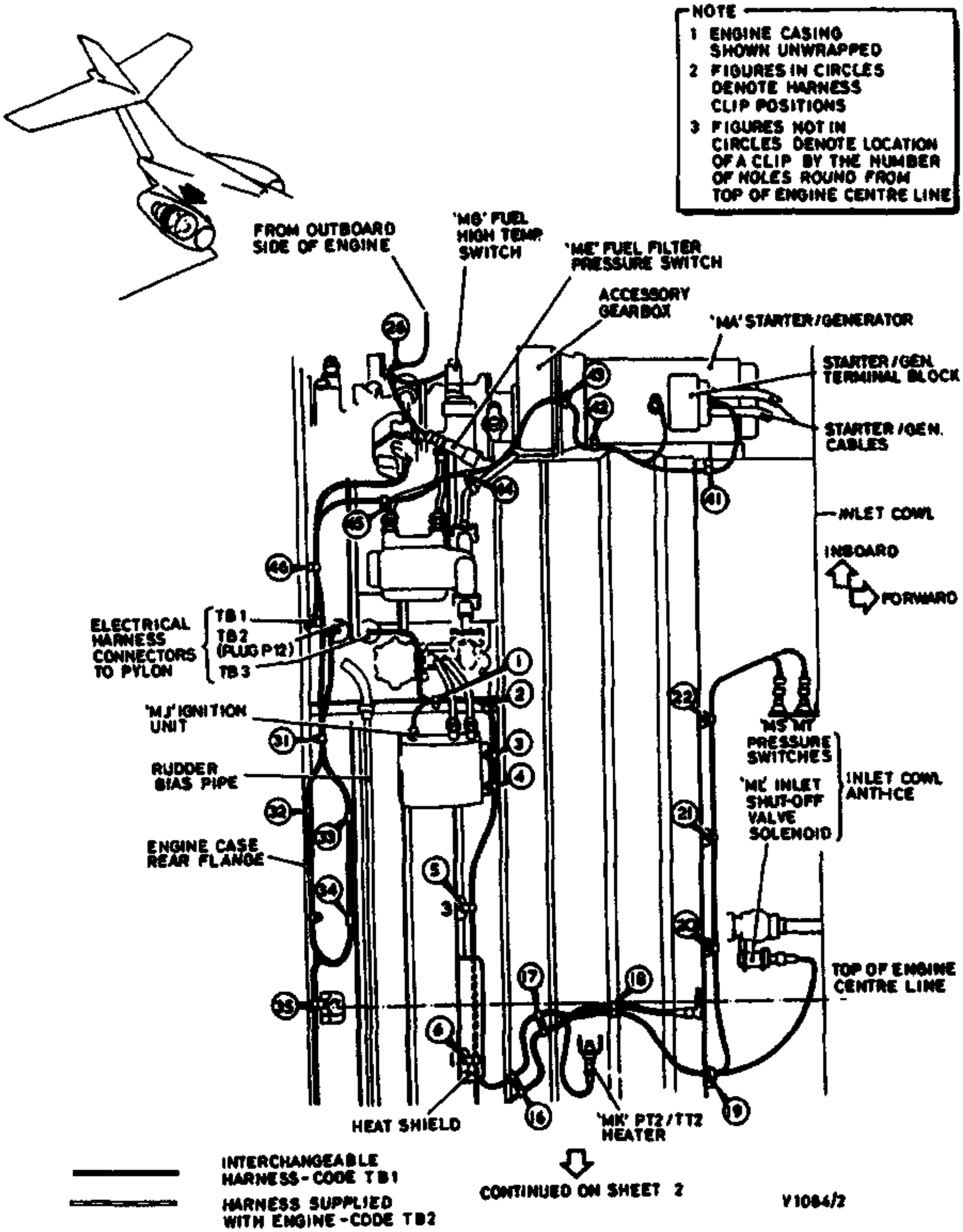
(j) Connect and tighten clips No.11 and 12 to existing brackets on engine casing.

*NOTE: Install clip No.13 when the aft cowl assembly is installed.*

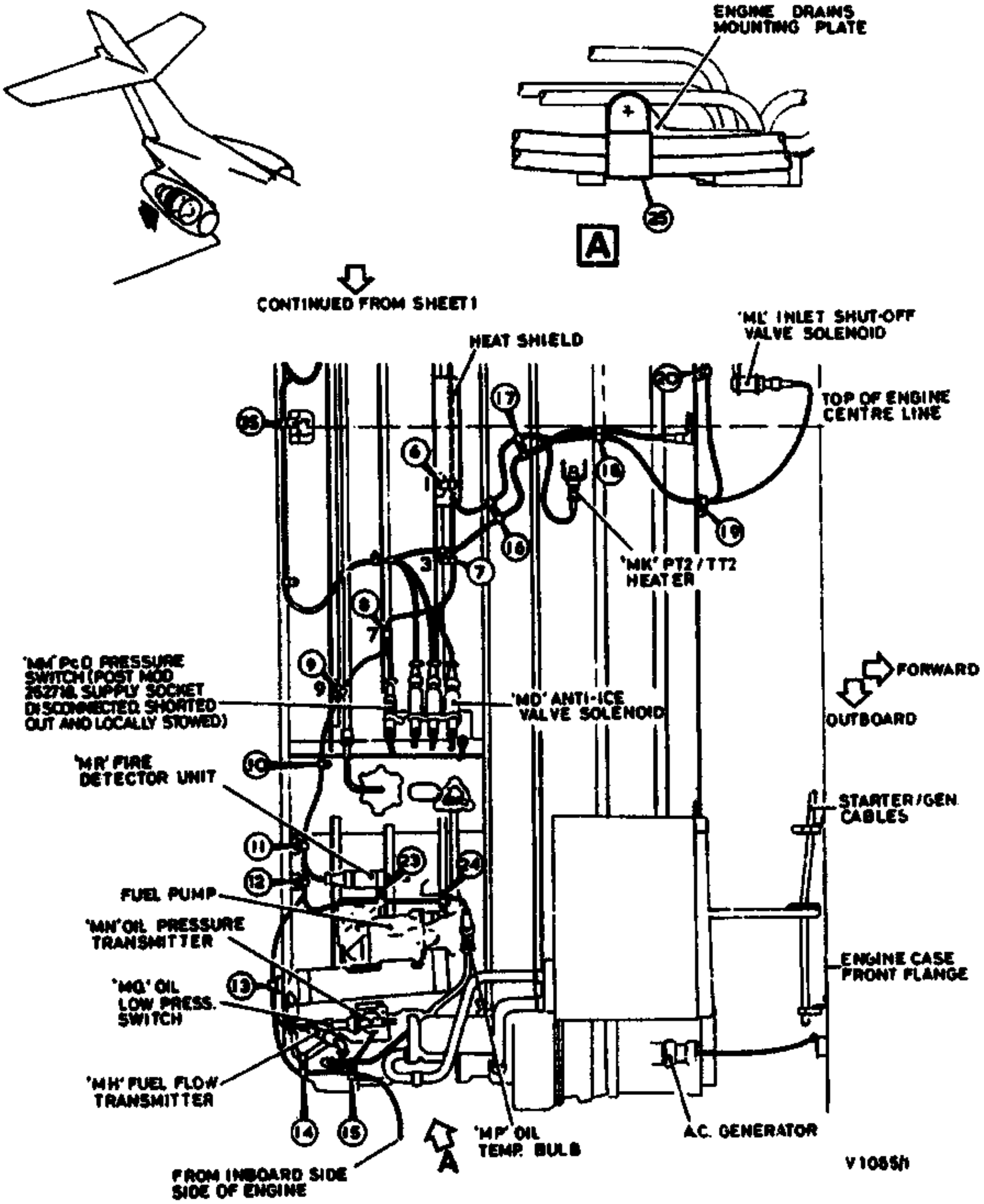
(k) Clamp clip No.14 to rear pipe and clip No.15 to forward pipe.

(l) Connect harness ends, G, J, K, L, M, N (Pre-Mod.252718), P to oil low pressure switch, fuel filter pressure switch, oil pressure transmitter, fuel flow transmitter, fire detection system detector, PcD pressure switch (Pre-Mod.252718), and anti-ice valve solenoid respectively.

(m) At clip positions No.16-18 remove nut and washer from TB2 harness existing clips, connect clips No.16-18 to existing bolts, install washers and nuts then tighten.


NOTE
1 ENGINE CASING SHOWN UNWRAPPED
2 FIGURES IN CIRCLES DENOTE HARNESS CLIP POSITIONS
3 FIGURES NOT IN CIRCLES DENOTE LOCATION OF A CLIP BY THE NUMBER OF HOLES ROUND FROM TOP OF ENGINE CENTRE LINE
FROM OUTBOARD SIDE OF ENGINE
'MB' FUEL HIGH TEMP SWITCH
'ME' FUEL FILTER PRESSURE SWITCH
ACCESSORY GEARBOX
'MA' STARTER/GENERATOR
STARTER/GEN. TERMINAL BLOCK
STARTER/GEN. CABLES
INLET COWL
INBOARD
FORWARD
26
43
42
44
45
41
46
ELECTRICAL HARNESS CONNECTORS TO PYLON
TB1
TB2 (PLUG P12)
TB3
'MJ' IGNITION UNIT
RUDDER BIAS PIPE
ENGINE CASE REAR FLANGE
1
2
3
4
31
32
33
34
35
5
3
6
17
18
16
19
22
21
20
'MS' 'MT' PRESSURE SWITCHES
'MC' INLET SHUT-OFF VALVE SOLENOID
INLET COWL ANTHICE
TOP OF ENGINE CENTRE LINE
HEAT SHIELD
'MK' PT2/TT2 HEATER
INTERCHANGEABLE HARNESS - CODE TB1
HARNESS SUPPLIED WITH ENGINE - CODE TB2
CONTINUED ON SHEET 2
V1084/2

Installation of electrical harnesses TB1/TB3
*Figure A416 (Sheet 1 of 2 - right engine)*


ENGINE DRAINS MOUNTING PLATE
25
A
CONTINUED FROM SHEET 1
HEAT SHIELD
'ML' INLET SHUT-OFF VALVE SOLENOID
TOP OF ENGINE CENTRE LINE
05
20
6
17
18
18
16
19
3
7
'MK' PT2 / TT2 HEATER
8
7
9
9
'MM' PcD PRESSURE SWITCH (POST MOD 252718, SUPPLY SOCKET DISCONNECTED, SHORTED OUT AND LOCALLY STOWED)
'MO' ANTI-ICE VALVE SOLENOID
FORWARD
OUTBOARD
10
'MR' FIRE DETECTOR UNIT
STARTER/GEN. CABLES
11
23
24
12
FUEL PUMP
'MN' OIL PRESSURE TRANSMITTER
ENGINE CASE FRONT FLANGE
13
'MQ' OIL LOW PRESS. SWITCH
'MH' FUEL FLOW TRANSMITTER
14
15
'MP' OIL TEMP. BULB
A.C. GENERATOR
A
FROM INBOARD SIDE SIDE OF ENGINE
V1085/1

Installation of electrical harnesses TB1/TB3
*Figure A416 (Sheet 2 of 2 - right engine)*

(n) Connect harness end C to the PT2/TT2 heater.

*NOTE: Connect clips No.19-22 when the inlet cowl assembly is installed.*

(o) Connect clip No.23 to fire detection system detector pick-up and torque tighten to 65-75 lbf in.

Table A407
Right engine - TB2 harness attachments- location, clipping and transfer details.

| Clip No. | Location | Transfer |
|---|---|---|
| 31 | Adjacent to TB2 plug break | P-clip. Discard existing P-clip - connects with existing bolt. |
| 32 | Aft cowl attachment flange | P-clip, bolt, washer and stiffnut. Connects with existing bracket on engine casing. |
| 33-34 | Adjacent to low pressure air pipe (rudder bias) | P-clip, bolt, washer and stiff-nut. Connects with existing bracket on engine casing. |
| 35 | Anti-icing pipe | P-clip, bolt, washer. Connects with existing bracket on engine casing. |

Table A408
Right engine - TB3 harness attachment- location, clipping and transfer details.

| Clip No. | Location | Transfer |
|---|---|---|
| 41 | Starter/generator | P-clip. Picks up on existing bolt. |
| 42 | Starter/generator speed sensor plug | Angle, P-clip, bolt, washer and stiffnut. Angle seats under hydraulic pump mounting nut. |
| 43 | Accessories gearbox | Angle, P-clip, bolt, washer and stiffnut. Angle connects with accessories gearbox. |
| 44 | Forward pipe | 2 P-clips, bolt, washer and stiffnut. Clamps to pipe. |
| 45 | Aft pipe | 2 P-clips, bolt, washer and stiffnut. Clamps to pipe. |
| 46 | Adjacent to TB3 plug break | P-clip. Discard existing P-clips connects to existing P-clip attachment bolt. |

(p) Connect and tighten clip No.24 to existing bracket on engine casing.

(q) Connect harness end F to oil temperature bulb.

*NOTE: Connect clip No.25 and 26 when the witness drains assembly is installed. The jiffy connector (fuel high temp.) is also connected to harness end H.*

*NOTE: Connect Harness ends D, E and Q when the inlet cowl has been installed.*

(13) Right engine - Connect and clip up harness TB2 *(Figure A416)*:

*NOTE: The numbers in circles on Figure A416 refer to clip numbers which, with their locations and assembly parts, are listed in Table A407.*

(a) At clip No.31 position, remove and discard existing TB2 harness clip, install transferred clip No.31 to harness, connect and tighten washer and nut.

(b) Install clips No.32-34 to harness, connect to existing brackets on engine casing and tighten.

(c) Connect clip No.35 to existing bracket on engine casing at the anti-icing pipe.

(d) Connect harness plug P12 to its counterpart at the pylon interface torque tighten to 120-130 lb/in. using the appropriate strap wrench (refer to Equipment required) and wirelock.

(14) Right engine - Install harness TB3 *(Figure A416):*

*NOTE: The numbers in circles on Figure A416 refer to clip numbers which, with their locations and assembly parts, are listed in Table A408.*

(a) Connect harness end A, coded TB3-M2, to its counterpart at the pylon interface and wire-lock.

(b) At clip position No.46, disconnect, remove and discard existing TB2 harness clip, install transferred clip No.46 to TB2 and TB3 harness, connect clip to existing bolt, install and tighten washer and nut.

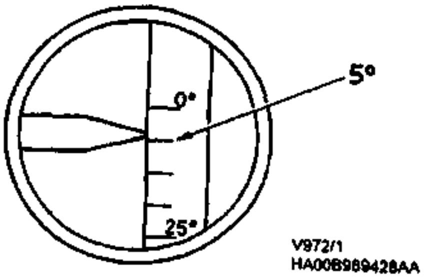
*NOTE: Connect clips No.45-41 when the starter/generator has been installed.*

(15) Install Teleflex control:

(a) Make sure that the high pressure fuel cock control lever is caged OFF.

(b) Check reading of power scheduling indicator on fuel control unit. (Figure A417)

*NOTE: Since the high pressure fuel cock control system rigging has not been disturbed, the indicator reading should be within 5 degrees of zero.*



Engine power scheduling indicator
*Figure A417*

(c) Remove sealing from end of fuel control unit.

(d) Locate the Teleflex box on the fuel control unit power shaft, install three attachment bolts and torque tighten bolts to 15-16 1/2 lbf in. Wirelock bolt heads.

*NOTE: For FCU power lever shaft protractor angles refer to Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Page block 401.*

(16) Install and connect engine rear mount matching shields and half plates (*Figures A407 and A408*).

*NOTE: The lower panel assembly was installed to locate N1 and ITT leads and fire detection system sensor.*

(a) Make sure caps are removed from the high pressure air bleed pipe joint.

(b) Lightly lubricate the pipe flanges and clamp abutment faces (refer to Materials).

(c) Install and connect pipe joint clamp. Torque tighten clamp bolt to 35-45 lbf in.

(d) Connect upper panel to the lower panel assembly using the pertinent bolts, washers, nuts from the aide-memoire panel. Tighten the bolts/ nuts (17 off).

(e) Install two matching shields to abut the upper panel and lower panel assembly (*Figure A407).*

(f) Install the seals, one with assembly slots uppermost and one with assembly slots lowermost, making sure that the ITT/N1 leads, cables and the slotted bush (on the fire detection system sensor) seat correctly.

(g) Install the remaining pair of matching shields, bolt up the shields and seals (12 bolts).

**CAUTION: DO NOT OVER TIGHTEN THESE BOLTS.**

(h) Install the lower and upper fairings by tightening 17 bolts.

(i) Connect the upper fairing to the lower fairing (6 bolts).

(j) Make sure pylon pressurization pipe is correctly seated in the pylon interface.

(17) Install exhaust pipe and tube assembly:

(a) Remove cap from thrust and exhaust nozzle.

(b) Position and locate the exhaust pipe complete with exhaust tube to the thrust and exhaust nozzle making sure the integral dowel pin correctly seats in its mating hole in the turbine case flange.

(c) Install the two halves of the exhaust tube clamp joining them with their T-bolts. Screw on the high temperature self-locking nuts an equal amount on each bolt.

(d) Torque tighten each nut to 45 lbf in.

(e) Lightly tap the circumference of the clamp halves with a non-metallic mallet.

(f) Re-torque tighten each nut as in paragraph (d).

(g) Repeat paragraphs (e) and (f).

(18) Install fan exhaust duct inner panels *(Figure A406):*

*NOTE: Tighten all screws progressively around the forward periphery.*

(a) Position and support the bottom panel, making sure it seats correctly on the engine rear mount lower fairing. Avoid contact with the fire detection system sensor.

(b) Attach panel at forward periphery using screws and washers.

(c) Lay top panel in position, making sure it seats correctly on the engine rear mount upper fairing.

(d) Attach panel at forward periphery and horizontal joints, using screws and washers.

(e) When located and secured, make sure top and bottom panels fit snugly around the exhaust tube assembly and all air holes and slots are unobstructed.

(f) Install the front fairing at the high pressure air bleed pipe, using screws/bolts and washers.

(19) Install aft cowl assembly *(Figure A405):*

(a) Position the cowl, making sure that it aligns with its attachment holes and with the vacant holes in the upper panel and lower panel assembly, at the engine rear mount.

(b) Left engine - Install cowl attachment bolts and nuts *(Figure A418):*

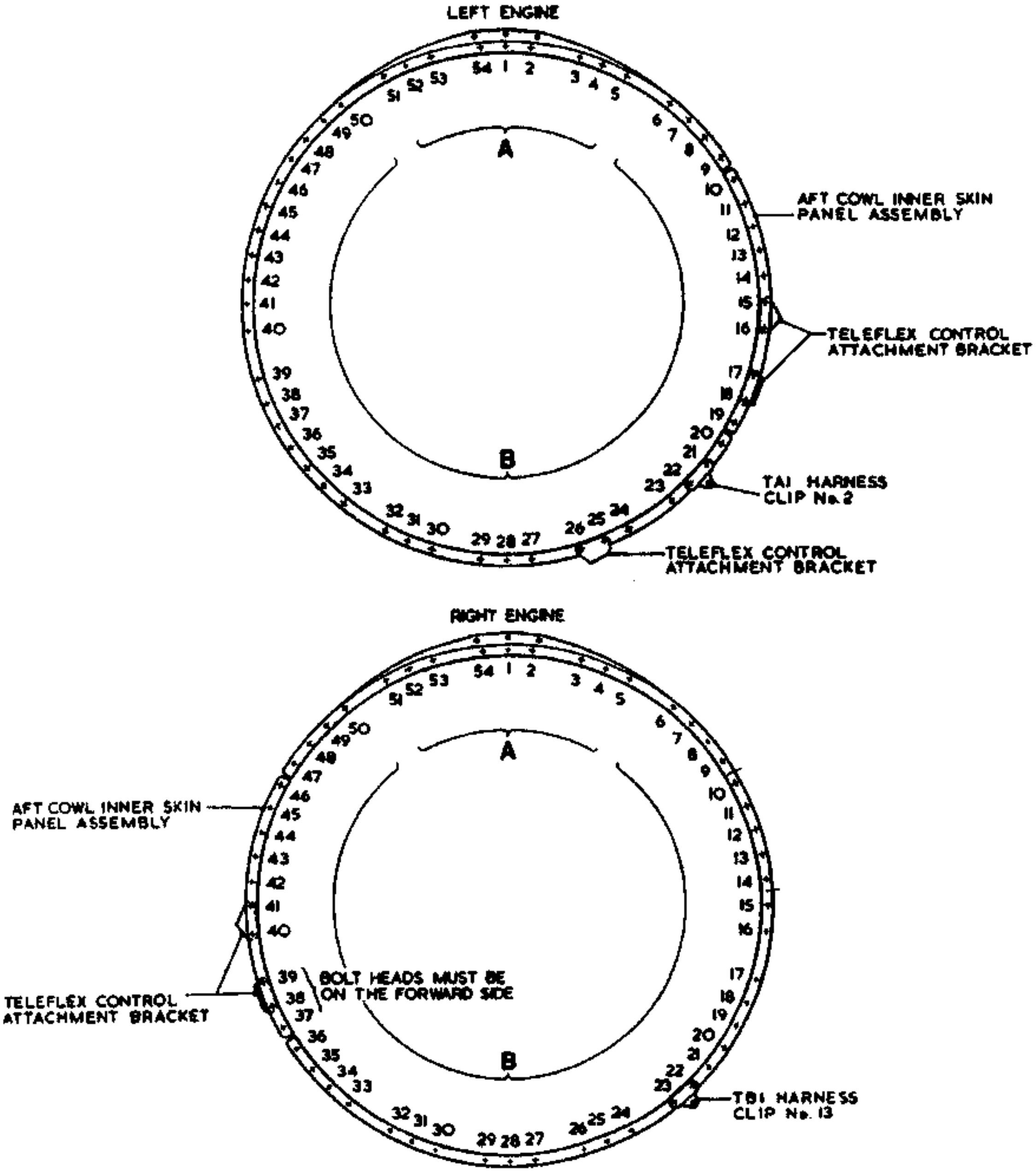
| | |
|---|---|
| 1 -9 | |
| 10-14 | Already installed. |
| 15-18 | Remember to connect Teleflex attachment brackets. |
| 19 | Already installed. |
| 20 | |
| 21-22 | Remember to connect TA1/TA3 harness clip No.2 bracket. |
| 23-24 | |
| 25-26 | Remember to connect Teleflex attachment bracket. |
| 27-54 | |

(c) Right engine - Install cowl attachment bolts and nuts *(Figure A418):*

| | |
|---|---|
| 1-21 | |
| 22-23 | Remember to connect TB1/TB3 harness clip No.13 bracket. |
| 24-37 | |
| 38-41 | Remember to connect Teleflex attachment brackets. |
| 42-47 | Already installed. |
| 48-54 | |

(d) Tighten all bolts.

(e) Install exhaust pipe cap.



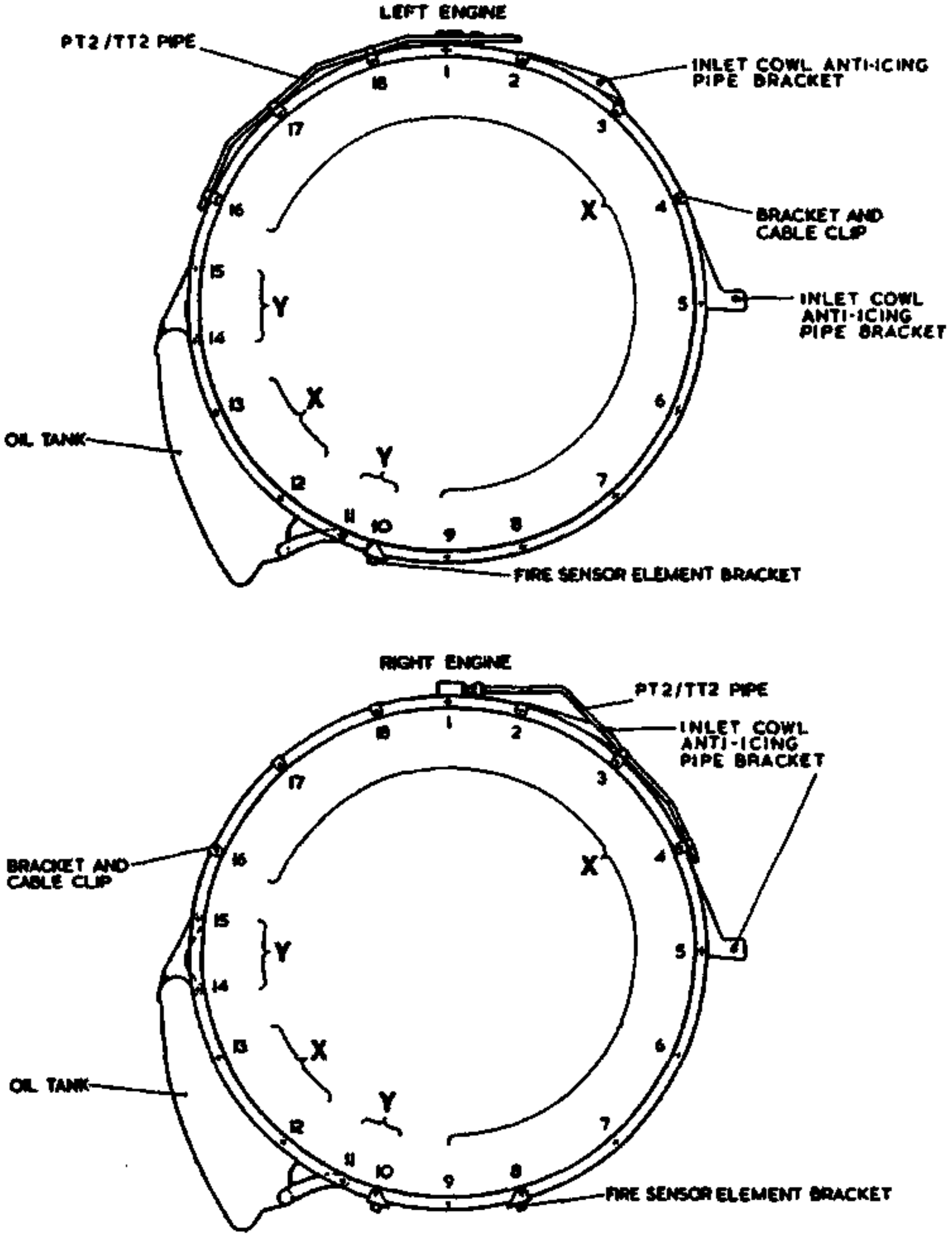
BOLT LOCATIONS (LOOKING FORWARD)

| HOLE REFERENCE No | BOLT | |
|---|---|---|
| | DIA | GRIP LENGTH |
| A {1 – 5<br>51 – 54} | 10/32 UNF | 0.562 IN |
| B 6 – 50 | 10/32 UNF | 0.312 IN |

WASHERS FITTED TO ALL BOLTS

V764/1

Aft cowl attachment
*Figure A418*


LEFT ENGINE
PT2/TT2 PIPE
INLET COWL ANTI-ICING PIPE BRACKET
BRACKET AND CABLE CLIP
INLET COWL ANTI-ICING PIPE BRACKET
OIL TANK
FIRE SENSOR ELEMENT BRACKET
X
Y
RIGHT ENGINE
PT2/TT2 PIPE
INLET COWL ANTI-ICING PIPE BRACKET
BRACKET AND CABLE CLIP
OIL TANK
FIRE SENSOR ELEMENT BRACKET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

ATTACHMENT LOCATIONS (LOOKING AFT)

| HOLE REFERENCE No. | ATTACHMENT |
|---|---|
| X 1 TO 9, 12 & 13, 16 TO 18 | BOLT 10/32 UNF (STANDARD) |
| Y 10 & 11 14 & 15 | BOLT 10/32 UNF (HEAD DRILLED FOR WIRE LOCKING) |
| | NUT 10/32 |
| | WASHER 10/32 |

V765/2

Inlet cowl attachments
*Figure A419*

(20) Left engine - Install inlet cowl, components *(Figure A419)*:

(a) Remove cap and gasket from hydraulic pump position on accessories gearbox and blank from fuel pipe connection on engine.

(b) Remove cap from fuel pipe on inlet cowl at the engine end.

(c) Remove cap from anti-icing pipe on inlet cowl.

(d) Lubricate hydraulic pump drive shaft (refer to Materials), install a new face gasket to hydraulic pump mounting face on accessories gearbox.

(e) Install a new O-ring seal to the engine end of the fuel pipe. Lubricate the seal with engine fuel.

(f) Tie up the oil tank securely, disconnect and remove attachment bolts No.11, 14 and 15 *(Figure A419)*.

(g) Position the inlet cowl complete with hydraulic pump, pipes and fuel pipe.

(h) Keeping the hydraulic pump drive shaft aligned with its mating drive in the accessories gearbox, manoeuvre the inlet cowl aft until the pump drive shaft engages and the pump mounting flange engages with the studs in the gearbox forward face and carefully push home. Locate fuel pipe in its aperture and on to engine mounted studs.

(i) Install bolts, washers and nuts to bolt positions 1, 6-9, 12 and 13, but do not torque tighten at this stage.

(j) Install bolts, washers and nuts to positions 11, 14 and 15. Remove tank lashing, but do not torque tighten at this stage.

(k) Connect and tighten PT2/TT2 pipe to valve on top of engine. Wire-lock pipe joint.

(l) Connect PT2/TT2 pipe clips at positions 16-18 using bolts, washers and nuts but do not torque tighten nuts at this stage.

(m) Connect TA1 harness clips No.13-16 to bolt positions 2, 3, 4 and 18 and anti-icing pipe brackets to bolt positions 2, 3, 4 and 5, but do not torque tighten at this stage.

(n) At fire detection system sensor attachments No.14 and 15, install slotted bushes to sensor. Connect brackets to bolt position 10 and to existing bracket adjacent to bolt position 8.

(o) Torque tighten all 18 attachment nuts to 30-35 lbf in.

(p) Wire-lock the heads of bolts 10, 11 and 14, 15 together as pairs.

(q) At fire detection system sensor attachment No.13, remove nut from engine, install slotted bush to sensor, close and tighten clamp. Install attachment bracket to engine, install nut and torque tighten to 65-75 lbf in.

(r) Install attachment nuts to hydraulic pump mounting studs with angle for TA3 harness clip No.43 under nut at top outboard position. Install remaining attachment nuts. Torque tighten nuts to 100-110 lbf in.

(s) Install nuts to fuel pipe attachments and torque tighten to 50-55 lbf in.

(21) Left engine - Install starter/generator:

(a) Disconnect and remove blanking plate at starter/generator position on accessories gearbox. Remove and discard face gasket.

(b) Install a new face gasket and starter/generator adapter with adapter air exhaust lowermost. Torque tighten adapter retaining nuts to 100-110 lbf in.

**CAUTION: STARTER GENERATORS POST SB. 72-3124 HAVE SELF LUBRICATING DRIVESHAFTS. ASSEMBLE DRY.**

(c) Lubricate drive shaft splines with grease (Pre SB. 72-3124 only) and clamp abutment faces (refer to Materials).

**WARNING: THE WEIGHT OF A STARTER/GENERATOR IS 35 LB.**

(d) Align the starter/generator with its adapter, engage drive shaft and carefully push home. Install clamp and connect clamp bolt, after making sure that the starter/generator heavy duty terminal block is on the same site as the hydraulic pump.

*NOTE: Make sure the clamp bolt end is positioned so that it will not foul the lower access door when the door is shut.*

(e) Torque tighten the clamp nut to 70-80 lbf in.

(f) Connect the flexible cooling air inlet to the starter/generator.

(22) Left engine - Install a.c. generator (if to be installed):

(a) Disconnect and remove cover plate from a.c. generator position on accessories gearbox. Remove and discard face gasket and washers but keep the retaining nuts.

(b) Install a new face gasket to the adapter mounting studs. Install adapter and retaining nuts.

(c) Torque tighten adapter retaining nuts to 100-110 lbf in. using a torque wrench adapter.

**CAUTION: A.C. GENERATORS POST SB. 72-3128 HAVE SELF LUBRICATING DRIVESHAFTS. ASSEMBLE DRY.**

(d) Lubricate drive shaft splines with grease (Pre SB. 72-3128 only) and connecting clamp abutment faces (refer to Materials).

**WARNING: THE WEIGHT OF AN A.C. GENERATOR IS 20 LB.**

(e) Align the a.c. generator with its adapter, engage drive shaft and carefully push home after making sure that its air exhaust aligns with the exhaust part in the lower access door. Install and connect clamp locating its closing bolt at 45 degrees above the supply socket.

*NOTE: It may be necessary to re-align the generator exhaust when installing the lower access door.*

(f) Torque tighten the clamp nut at 70-90 lbf in.

(23) Left engine connections - Pre-Mod.252779

(a) Before connecting the starter/generator heavy-duty cables, make sure that cable protrusion from the fairlead *(Figure A420)* at the pylon interface is:

| | |
|---|---|
| +ve cable = 3 ft 2.0 in.<br>-ve cable = 3 ft 2.25 in. | from pylon fairlead to center of cable lug eye-end measured in a straight line. |

*NOTE: If the cable protrusion is correct, proceed as in paragraph (25). If the protrusion is not correct, embody Mod.252779 (new shorter cables incorporating shrunk-on locating sleeves to define correct protrusion).*

(b) Route and clamp/clip-up starter/generator and a.c. generator cables.

(c) Connect output socket to a.c. generator and locally clip cables to drip tray.

(24) Left engine connections - Mod.252779

(a) Before connecting starter/generator heavy-duty cables, make sure that the cable locating sleeves abut the pylon fairlead.

(b) Do paragraphs (23) (b) and (c).

(25) Left engine - Connect starter/generator light and heavy duty cables:

(a) Attach heavy duty cables to terminal block, install washers and nuts.

(b) Torque tighten nuts to 100 lbf in.

(c) Roll cable rubber boot to cover terminal block.

(d) Connect light duty cables.

(e) Connect speed sensor cable connector to socket on starter/generator.

(f) Aircraft Pre-Mod.252779 - Re-install TY9 cable strappings at the positions previously vacated.

(g) Aircraft with Mod.252779 - Re-install LK3 cable strappings at the positions shown in *Figure A420.*

(26) Left engine - Clip and connect electrical harness:

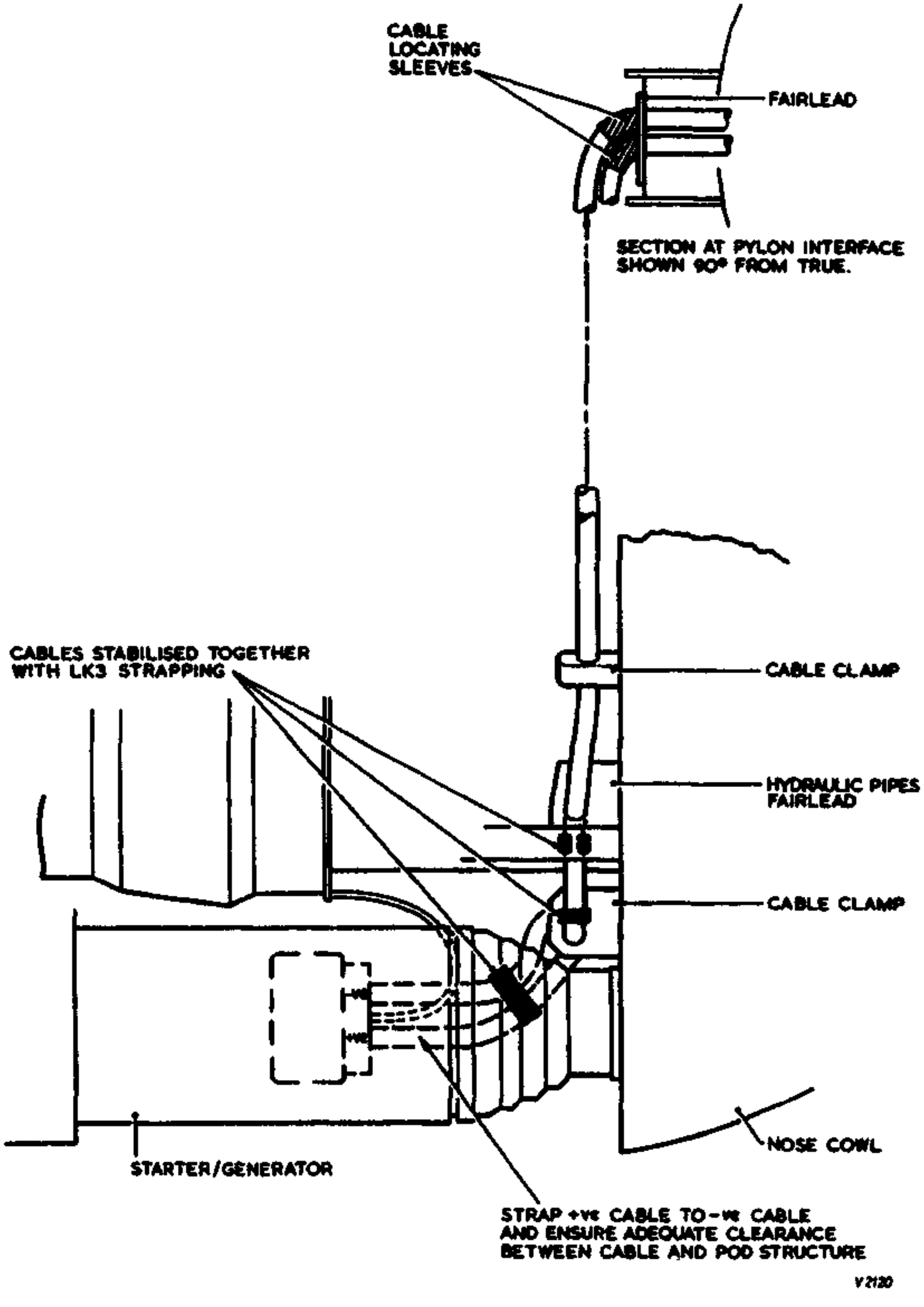
(a) Connect TA3 harness clip No.41 to existing local bolt.

(b) Clamp TA3 harness clip No.42 to hydraulic pump suction pipe.

(c) Connect TA3 harness clip No.43 to angle already installed on hydraulic pump mounting.

(d) Remove nut from accessories gearbox at TA3 harness clip No.44, attach clip mounting angle. Re-install and torque tighten nut to 60-66 lbf in. Connect clip No.44 to angle.

(e) Connect TA3 harness clip No.45 to existing angle on accessories gearbox.


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMP
HYDRAULIC PIPES FAIRLEAD
CABLE CLAMP
-ve
+ve
NOSE COWL
STARTER/GENERATOR
STRAP +ve CABLE TO -ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2120

Location of starter/generator heavy duty cables - Mod.252779 - left engine
*Figure A420*

(f) Clamp TA1 harness clip No.4 and TA3 harness clip No.46 to the forward pipe.

(g) Clamp TA1 harness clip No.3 and TA3 harness clip No.47 to the aft pipe.

(h) Connect TA1 harness clip No.2 and TA3 harness clip No.48 to existing bracket on engine casing.

(i) Connect TA3 harness clip No.49 to existing bracket on engine casing.

(j) Connect TA1 harness ends D, E and O to the inlet anti-ice (FLT) pressure switch, coded LS, inlet shut-off valve, coded LL and inlet anti-ice (GND) pressure switch, coded LT respectively.

(27) Left engine - Lubricate the abutment face of the clamp connecting the inlet cowl anti-icing air supply pipe to the shut-off valve (refer to Materials). Install clamp and tighten clamp nut to 35-45 lbf in.

(28) Right engine - Install inlet cowl and components *(Figure A419)*:

(a) Remove cap and face gasket from hydraulic pump position on the accessories gearbox and cap from fuel pipe connection on engine. Discard the gasket.

(b) Remove cap from fuel pipe on inlet cowl at the engine end.

(c) Remove cap from anti-icing pipe on inlet cowl.

(d) Lubricate hydraulic pump drive shaft (refer to Materials). Install a new face gasket to the hydraulic pump mounting face on accessories gearbox.

(e) Install a new O-ring seal to the engine end of the fuel pipe. Lubricate the seal with engine fuel.

(f) Tie up the oil tank securely, disconnect and remove attachment bolts No.11, 14 and 15 *(Figure A419)*.

(g) Untie the hydraulic pump restraint and support pump.

**CAUTION: DO NOT ALLOW PUMP TO HANG ON PIPES.**

(h) Keeping the hydraulic pump drive shaft aligned with its mating drive on the accessories gearbox carefully engage the drive and push home.

(i) Install attachment nuts to the hydraulic pump mounting studs, with angle for TB3 harness clip No.42 under nut at top outboard position. Torque tighten nuts to 100-110 lbf in.

(j) Position the inlet cowl complete with fuel pipe and locate the fuel pipe in its aperture on the engine and on to the engine mounted studs.

(k) Install bolts, washers and nuts to bolt positions 1, 6-7, 12 and 13 but do not torque tighten at this stage.

(l) Install bolts, washers and nuts to bolt positions 11, 14 and 15 but do not torque tighten at this stage. Release and remove oil tank support lashing.

(m) Connect and tighten PT2/TT2 pipe to shut-off valve on top of the engine and wire-lock pipe joint.

(n) Connect PT2/TT2 pipe clips at positions 3 and 4 using bolts, washers and nuts but do not torque tighten at this stage.

(o) Connect TB1 harness clips No.19-22 to bolt positions 2, 3, 4 and 18 and anti-ice pipe brackets to bolt positions 2, 3, 4 and 5 but do not torque tighten at this stage.

(p) At fire detection system sensor attachments No.14 and 15, install slotted bushes to sensor. Close and tighten clamps then connect brackets to bolt positions 8 and 10 respectively.

(q) Torque tighten all 18 attachment nuts to 30-35 lbf in.

(r) Wire-lock the heads of bolts 10 and 11, 14 and 15 together as pairs.

(s) At fire detection system sensor attachment No.13, remove nut from engine and install slotted bush to sensor, close and tighten clamp. Install attachment bracket to engine, install nut and torque tighten to 65-75 lbf in.

(t) Install nuts to fuel pipe attachment and torque tighten to 50-55 lbf in.

(29) Right engine - Install starter/generator:

(a) Disconnect and remove sealing plate at starter/generator position on accessories gearbox. Remove and discard face gasket.

(b) Install a new face gasket and the starter/generator adapter, with the adapter air exhaust lowermost. Torque tighten adapter retaining nuts to 100-110 lbf in.

**CAUTION: STARTER/GENERATORS POST SB. 72-3124 HAVE SELF LUBRICATING DRIVESHAFTS. ASSEMBLE DRY.**

(c) Lubricate drive shaft splines with grease (Pre SB. 72-3124 only) and clamp abutment faces (refer to Materials).

**WARNING: THE WEIGHT OF A STARTER/GENERATOR IS 35 LB.**

(d) Align the starter/generator with its adapter, engage the drive shaft and carefully push home. Install clamp and connect clamp bolt, making sure that the starter/generator terminal block is on the same side as the hydraulic pump.

*NOTE: Make sure the clamp bolt end is positioned so that it will not foul the access door when the door is shut.*

(e) Torque tighten the clamp nut to 70-80 lbf in.

(f) Connect the flexible cooling air inlet to the starter/generator.

(30) Right engine - Install a.c. generator:

(a) Disconnect and remove cover from a.c. generator position on accessories gearbox. Remove and discard face gasket and washers but keep the retaining nuts.

(b) Install a new face gasket to the adapter mounting studs. Install adapter and retaining nuts.

(c) Torque tighten adapter retaining nuts to 100-110 lbf in. using a torque wrench adapter.

**CAUTION: A.C. GENERATORS POST SB. 72-3128 HAVE SELF LUBRICATING DRIVESHAFTS. ASSEMBLE DRY.**

(d) Lubricate drive shaft splines with grease (Pre SB. 72-3128 only) and connecting clamp abutment faces (refer to Materials).

**WARNING: THE WEIGHT OF AN A.C. GENERATOR IS 20 LB.**

(e) Align the a.c. generator with its adapter, engage drive shaft and carefully push home making sure that its air exhaust aligns with the exhaust port in the lower access door. Install and connect clamp, locating its closing bolt at 45 degrees above the supply socket.

*NOTE: It may be necessary to realign the generator exhaust when installing the lower access door.*

(f) Torque tighten the clamp nut at 70-90 lbf in.

(31) Right engine connections - Pre-Mod.252779

(a) Before connecting the starter/generator heavy duty cables, make sure that cable protrusion from fairlead *(Figure A421)* at pylon interface is:

| | |
|---|---|
| +ve cable = 2 ft 6.5 in. | from pylon fairlead to center of cable lug eye-end measured |
| -ve cable = 2 ft 7.0 in. | in a straight line. |

*NOTE: If the cable protrusion is correct, proceed as in paragraph (32). If protrusion is not correct, embody Mod.252779 (new shorter cables incorporating shrunk-on locating sleeves to define correct protrusion).*

(b) Route and clamp/clip-up starter/generator and a.c. generator cables.

(c) Connect output socket to a.c. generator and locally clip up cables.

(32) Right engine connections - Mod.252779

(a) Before connecting starter/generator heavy duty cables, make sure that the cable locating sleeves abut the pylon fairlead.

(b) Do paragraphs (31) (b) and (c).

(33) Right engine - Connect starter/generator light and heavy duty cables:

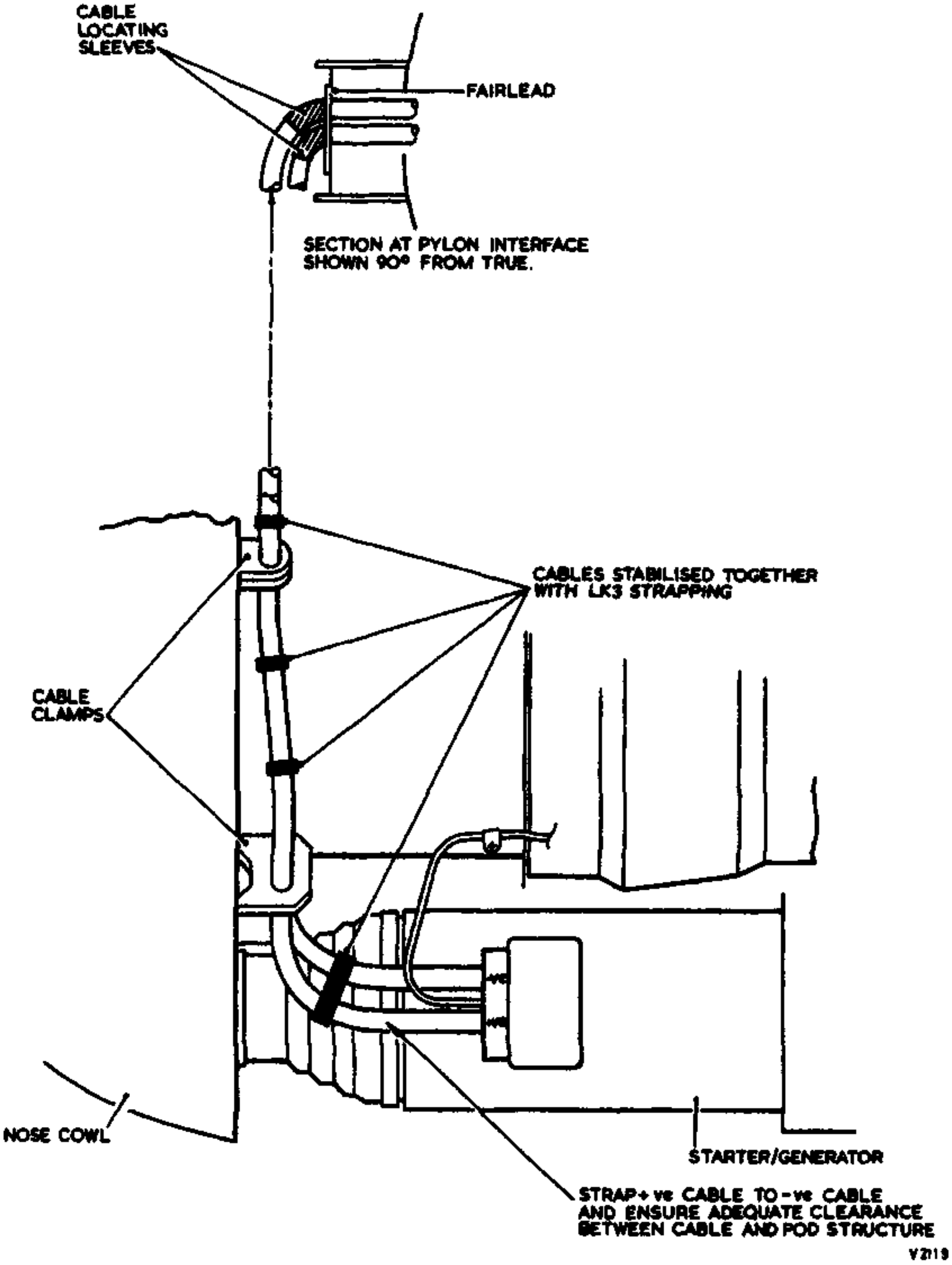
(a) Attach heavy duty cables to terminal block, install washers and nuts.

(b) Torque tighten nuts to 100 lbf in.

(c) Roll cable rubber boot to cover terminals.

(d) Connect light duty cables.

(e) Connect speed sensor connector to socket on starter/generator.


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMPS
+ve
-ve
NOSE COWL
STARTER/GENERATOR
STRAP +ve CABLE TO -ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2119

Location of starter/generator heavy duty cables - Mod.252779 - right engine
*Figure A421*

(f) Aircraft Pre-Mod.252779 - Re-install TY9 cable strappings at the positions previously vacated.

(g) Aircraft with Mod.252779 - Re-install LK3 cable strapping at positions shown in *Figure A421*.

(34) Right engine - Clip and connect electrical harnesses:

(a) Connect TB3 harness clip No.41 to existing bolt.

(b) Connect TB3 harness clip No.42 to angle already installed on hydraulic pump mounting.

(c) Remove nut from accessories gearbox at TB3 harness clip No.43. Attach clip mounting angle, re-install and torque tighten nut to 60-66 lbf in. Connect clip No.43 to angle.

(d) Clamp TB3 harness clips No.44 and 45 to the front and rear pipes respectively.

(e) Remove and discard clip at position No.46 and install transferred clip to locate TB2 and TB3 harnesses.

(f) Connect TB1 harness ends D, E and Q to the inlet anti-ice (FLT) pressure switch, coded MS, inlet shut-off valve, coded ML and inlet anti-ice (GND) pressure switch, coded MT, respectively.

(35) Right engine - Lubricate the abutment faces of the clamp connecting the inlet cowl anti-icing air supply pipe to the shut-off valve (refer to Materials). Install clamp and tighten clamp nut to 35-45 lbf in.

(36) Right engine - Clamp TB1 harness clips No.14 and 15 to the aft and forward pipes respectively.

(37) Install witness drains:

(a) Remove hydraulic pump elbow from drains assembly and install a new O-ring seal to the elbow. Screw the elbow into the accessories drive but do not tighten the elbow at this stage.

(b) Remove starter/generator elbow from drains assembly and install a new O-ring seal. Screw the elbow into the accessories drive but do not tighten the elbow at this stage.

(c) Remove a.c. generator elbow from drains assembly installed to the right engine or left engine (if appropriate). Install a new O-ring seal to the elbow and screw the elbow into the accessories gearbox but do not tighten at this stage.

(d) Remove fuel pump elbow from drains assembly and install a new O-ring seal to the elbow. Screw the elbow into the fuel pump but do not tighten at this stage.

(e) Remove fuel control unit elbow from drains assembly and install a new O-ring. Screw the elbow into the fuel control unit but do not tighten at this stage.

(f) Remove cap from engine breather and install a new O-ring seal to the breather vent, screw breather vent into engine casing and tighten.

(g) Remove nut from engine mounted stud and slide the drains assembly on to the breather vent and connect drains mounting plate to engine mounted stud.

(h) Align pipe elbows with pipes and connect up.

(i) Tighten mounting plate clamp on breather vent.

(j) Tighten pipe joints and elbow lock nuts and wire-lock each pipe joint.

(k) At the engine mounted stud, connect TA1/TA3 harness P-clip No.26 (left engine) or TB1/TB3 harness clip No.25 (right engine) and torque tighten nut to 25-30 lbf in.

(l) Connect TA1 harness end L (left engine) or TB1 harness end H (right engine) to the local jiffy connector.

(m) Right engine only - Clamp TB1 harness P-clip No.26 to the fuel control unit drain pipe.

(38) Connect remaining services at pylon interface:

(a) Remove caps from the PT2/TT2 pipe and its counterpart. Connect PT2/TT2 pipe, tighten and wire-lock.

(b) Remove caps from fuel pipe and its counterpart. Connect fuel pipe, tighten and wire-lock.

(c) Left engine only - Remove caps from hydraulic flexible pipes and their counterparts. Connect pipes, tighten and wire-lock.

(d) Remove cap from rudder bias pipe and its counterpart. Connect, tighten and wire-lock pipe.

(e) At the low pressure air connector to mixer valve pipe joint, lubricate the abutment faces of the joint clamp (refer to Materials). Install and connect the clamp. Torque tighten the clamp nut to 35-40 lbf in.

(39) Make sure TA2 electrical harness (left engine) or TB2 (right engine) is connected to:

(a) N2 transducer (4 pin plug coded P4). Torque tighten plug to 70-75 lbf in. using the appropriate strap wrench (refer to Equipment).

(b) PTZ sensor (4 pin plug coded P8). Torque tighten to 70-75 lbf in.

(c) Solenoid A (3 pin plug coded P16) and solenoid B (2 pin plug coded P17) on anti-ice controller. Torque tighten plugs P16 and P17 to 26-32 lbf in.

(d) Fuel control unit (10 pin plug coded P6 and 4 pin plug coded P7). Torque tighten plugs to 46-50 and 70-75 lbf in. respectively using the appropriate strap wrenches (refer to Equipment).

(40) Install remaining bolts to upper panel and lower panel assembly at engine rear mount *(Figure A408)*.

(41) Restore integrity of electrical circuits. Install fuses and close circuit breakers (refer to Table A401).

(42) Make sure that SB.TFE731-73-3107 (BAe Mod.253280A, SB.73-23-3280A - To provide additional support for engine fuel pipe) has been embodied on this engine.

### E. Post installation, procedures

*NOTE: Do not install the upper panel, lower access door around engine Zone 1 and the access panels in the pylon upper and lower surfaces until the Post installation procedures have been satisfactorily concluded.*

(1) Left engine only - Prime hydraulic pump:

(a) Make sure the hydraulic reservoir is full.

(b) Remove the vent plug from the top of the pump.

(c) Remove notice and set the appropriate high pressure fuel cock lever to ON.

(d) When there is a free flow of fluid from the vent, return the high pressure fuel cock lever to OFF.

(e) Re-install, tighten and wire-lock the vent plug.

(f) At the next engine run, do a leak check at the vent plug.

(2) Depreserve the engine - Allied Signal, Light Maintenance Manual, Report No.72-02-15, Chapter 72-00-00, GENERAL SERVICING - DEPRESERVATION.

(3) Ground test the engine - Chapter 71-00-00, - POWER PLANT - ADJUSTMENT/TEST.

### F. Close up

(1) Install the top and bottom outer panels to the aft cowl assembly at the engine rear mount.

(2) Install upper panel:

(a) Locate the upper panel on the engine. Take care that its hinge bars do not damage local electrical cables.

(b) Align the bolt holes (3 off) at the forward edge of the panel and install securing bolts but do not tighten at this stage.

(c) Align the panel shear pins (2 off) with their assembly housings on the aft cowl assembly and close the shear pin latches.

(d) Tighten the panel securing bolts installed in paragraph (b).

(3) Install lower access door:

(a) Position the lower access door up to the hinge bars on the upper panel. Close the hinge latches and make sure that they seat flush.

(b) Temporarily close the door and check alignment of a.c. generation exhaust with aperture on the door.

*NOTE: If necessary, re-align exhaust and retorque clamp nut to 70-90 lbf in.*

(c) Close the door and push in the latches and make sure that they seat flush.

(d) Make sure engine breather pipe seal on inner face of door does not obstruct breather pipe orifice (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50% renew the seal (Chapter 71-10-00, COWLINGS - SERVICING).*

(4) Close or install access panels in the pylon upper and lower surfaces.

### G. Return of engine to manufacturer

Before returning an engine for repair or overhaul, operators should refer to Service Information Letter F731-24. The S.I.L. portrays the proper configuration by way of a series of photographs. Operators are advised to comply with the configuration detail.

# POWER PLANT - REMOVAL/INSTALLATION
# POWER PLANT CHANGE

## 1. Remove power plant

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF ENGINES. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER COMPONENT IS REMOVED, IMMEDIATELY INSTALL A CAP TO THE APERTURE.**

| Equipment/Material | Part/Item No. |
|---|---|
| Power plant sling | 25-7Y9-A |
| Power plant stand | 25-7Y-25A or equivalent |
| Drip trays | – |
| Drains container (approx 5 Imp.gal. capacity) | – |

### A. Prepare to remove power plant

(1) General

(a) The sequence of operations given are those to remove a power plant for subsequent re-installation.

(2) Arrange for attendance of mobile hoisting gear or make sure aircraft is positioned beneath an overhead hoisting gantry.

*NOTE: Hoisting gear must have a 'Safe Working Load' capacity of not less than 1,200 lb.*

(3) Prepare an empty stand to receive the removed power plant.

(4) Position and prepare the aircraft:

(a) Make sure lock pins 25-Y-33A and 25-Y-197A are installed to the nose and main landing gear units respectively.

(b) Apply brakes and chock wheels fore and aft.

*NOTE: If aircraft is on jacks, use wing steady trestles.*

(c) Make sure air intake plugs and exhaust covers are installed both before and after removal of cowlings.

(5) Hydraulic system tank air pressure:

(a) Unscrew the tank filler cap two turns only.

(b) Allow residual air pressure to disperse.

(6) Release hydraulic system main accumulator pressure:

  (a) With a 28 volt d.c. ground power supply connected, operate the flaps or air brakes until the pressure indicator reading reduces to 2,700 psi.

  (b) With the handbrake lever set fully forward exercise the footbrake pedals until, with the brakes fully ON, the associated indicators read zero.

(7) Release hydraulic system emergency brake accumulator pressure:

  (a) Set the brake lever to the red sector and exercise the footbrake pedals until the accumulator pressure gauge reads between 950 and 1000 psi.

(8) Make sure that the appropriate LP and HP fuel cock levers are set at OFF. Fix a notice to the levers forbidding interference.

(9) Uncowl the power plant:

  (a) At the inboard latches on the lower access door insert a short screwdriver (approximately three inches long) into each facia slot in turn and lever outward to release. Open the access door.

  (b) With the lower access door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into the facia hole and lever outward to release. Remove the access door.

  (c) At the aft edge of the upper panel, insert a suitable 0.25 in. diameter rod into the facia hole of each shear pin latch in turn and lever outward to release.

  (d) At the forward edge of the upper panel, remove the three countersunk bolts securing the panel to the inlet cowl. Carefully remove the upper panel making sure that its hinge bars (3 off) do not damage local electrical cables or looms.

(10) Isolate electrical power supplies by removing circuit fuses and opening circuit breakers (Table B401).

(11) Remove the access panels from the pylon top and bottom surfaces at the engine front and rear mounts and the systems access panel.

(12) Place drip trays beneath the power plant.

**B. Disconnect electrical services** *(Figures B401, B402 and B403)*

**CAUTION: AFTER DISCONNECTING CABLES MAKE SURE THAT THEY ARE EASILY IDENTIFIABLE. IF NECESSARY, INSTALL IDENT TAGS TO FACILITATE SUBSEQUENT CORRECT RECONNECTION.**

(1) Disconnect the N1 monopole and ITT harness at the power plant/pylon interface:

  (a) Remove the four bolts securing the terminal cover and remove the cover.

  (b) Loosen locknuts, disconnect N1 monopole connector plug, coded TV1 (left) or TW1 (right).

  (c) Loosen locknuts, disconnect ITT computer connector plug, coded TV2 (left) or TW2 (right).

  (d) Pre-Mod.252657: remove fairleads and tie up locally at the pylon.

  (e) Disconnect the two ITT indicator leads from terminal block, coded LY (left) or MY (right). Post-Mod.252657, pull the indicator leads through the mounting bracket.

(2) Disconnect the three electrical connectors, TA1, TA2 and TA3, (left) or TB1, TB2 or TB3 (right) at the pylon/power plant interface.

(3) Release the starter/generator heavy duty cables from the generator:

  (a) Slide back the starter/generator terminals protective boot.

  (b) Remove the nuts and washers or screws and disconnect the heavy duty cables from the starter/generator.

(4) Left engine disconnections:

  (a) Unclip cables from fuel and hydraulic pipes back as far as the fuel filter.

  (b) Uncleat cables back to the pylon.

  (c) Disconnect speed sensor connector from the starter/generator.

  (d) Secure cables clear of the power plant.

(5) Right engine disconnections:

  (a) Unclip cables back as far as the oil pipe.

  (b) Uncleat cables back to the pylon.

  (c) Disconnect speed sensor connector from the starter/generator.

  (d) Secure cables clear of the power plant.

(6) Disconnect a.c. generator electrical cables - right engine or left engine (if installed):

  (a) Disconnect the electrical plug from the a.c. generator.

  (b) Unclip cables back to the pylon.

  (c) Secure the cables clear of the power plant.

**C. Disconnection of mechanical services and components** *(Figures B401, B402, B403 and B404)*

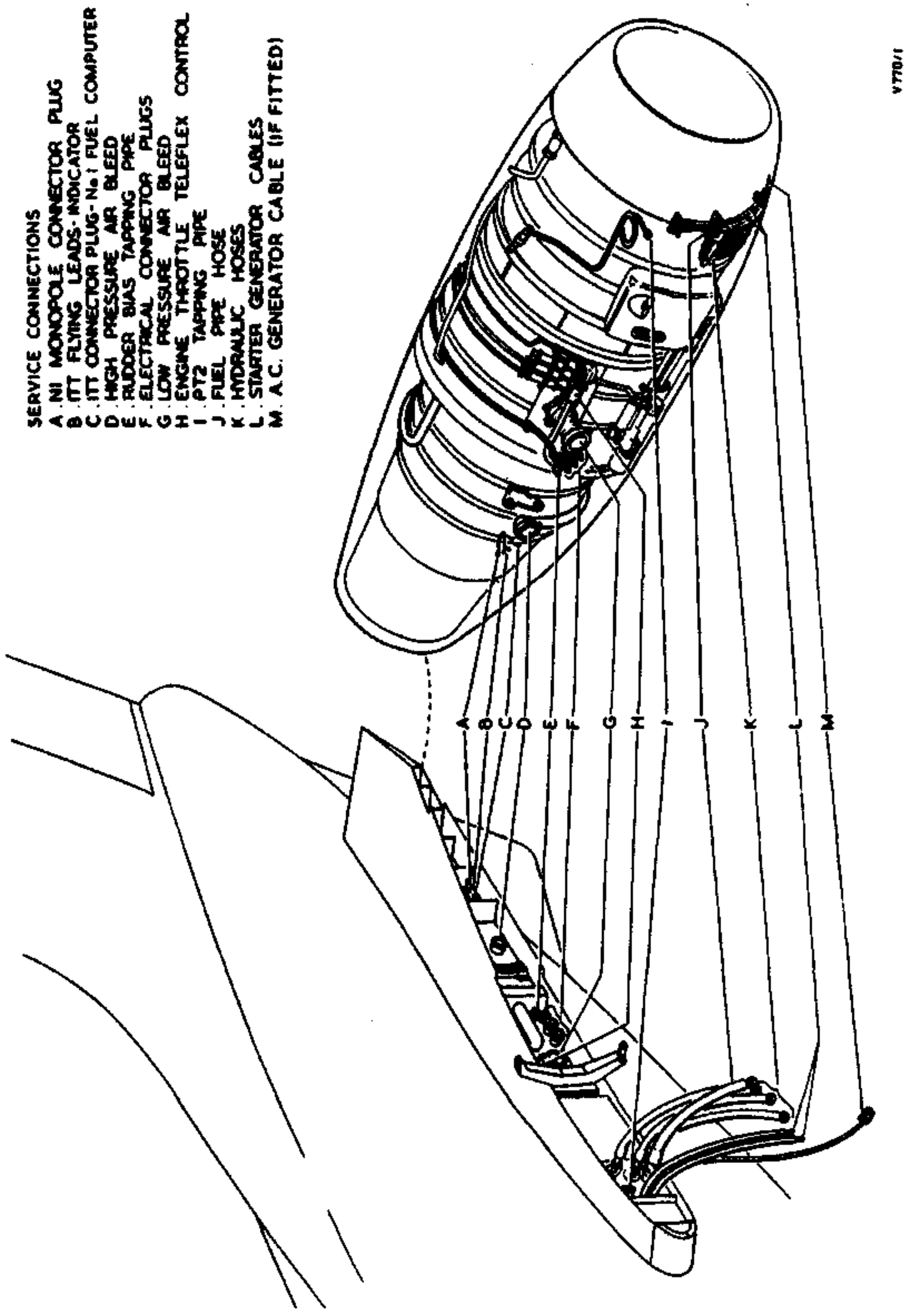
(1) Release the V-clamp bolt of the engine high-pressure air bleed duct at the pylon disconnect coupling. Remove the clamp.

(2) Disconnect the rudder bias system pipe at the pylon disconnect point.

(3) Release the engine low-pressure air bleed pylon connector clamp bolt. Remove the V-clamp.

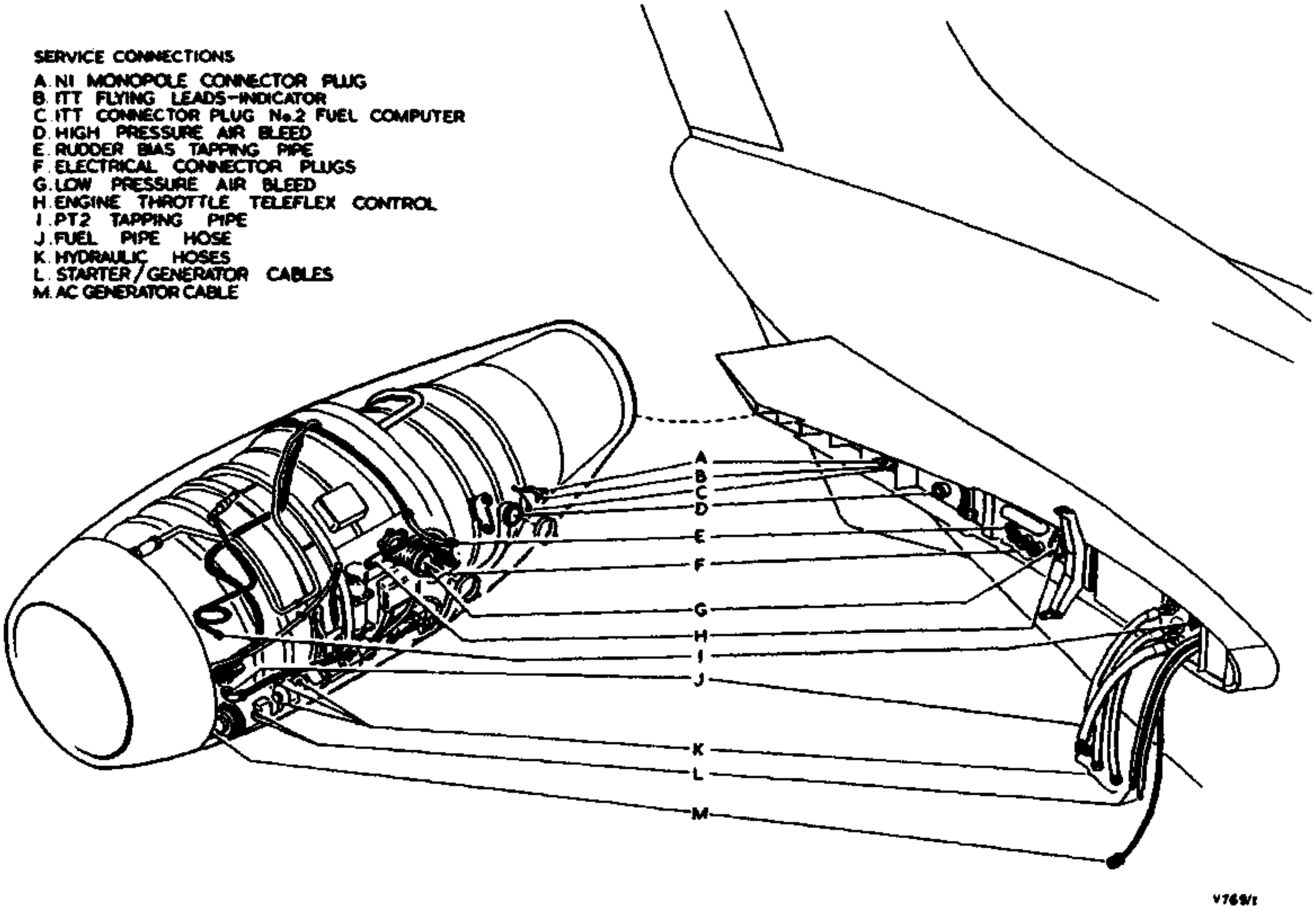
(4) Disconnect the throttle/high pressure fuel cock Teleflex control brackets, disconnect Teleflex control unit from fuel control unit and secure clear of the power plant. Retain Teleflex control unit attachment bolts.

(5) Disconnect PT2/TT2 pipe at the pylon disconnect junction. Blank off each open end of the system.


SERVICE CONNECTIONS
A. N1 MONOPOLE CONNECTOR PLUG
B. ITT FLYING LEADS-INDICATOR
C. ITT CONNECTOR PLUG-No 1 FUEL COMPUTER
D. HIGH PRESSURE AIR BLEED
E. RUDDER BIAS TAPPING PIPE
F. ELECTRICAL CONNECTOR PLUGS
G. LOW PRESSURE AIR BLEED
H. ENGINE THROTTLE TELEFLEX CONTROL
I. PT2 TAPPING PIPE
J. FUEL PIPE HOSE
K. HYDRAULIC HOSES
L. STARTER GENERATOR CABLES
M. A.C. GENERATOR CABLE (IF FITTED)
A
B
C
D
E
F
G
H
I
J
K
L
M
V770/1

Power plant services connections - left engine

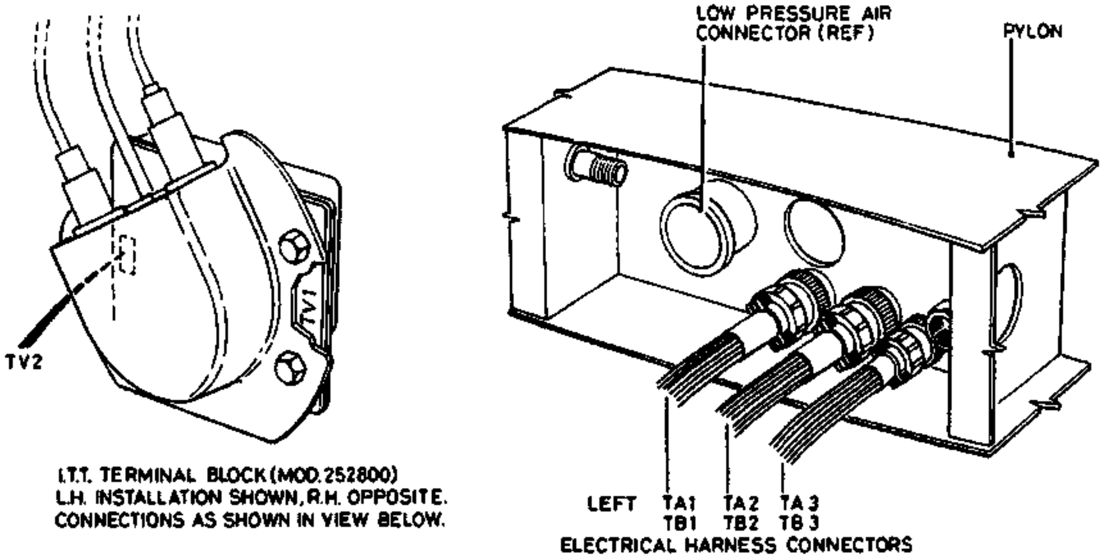
*Figure B401 (Sheet 1 of 2)*



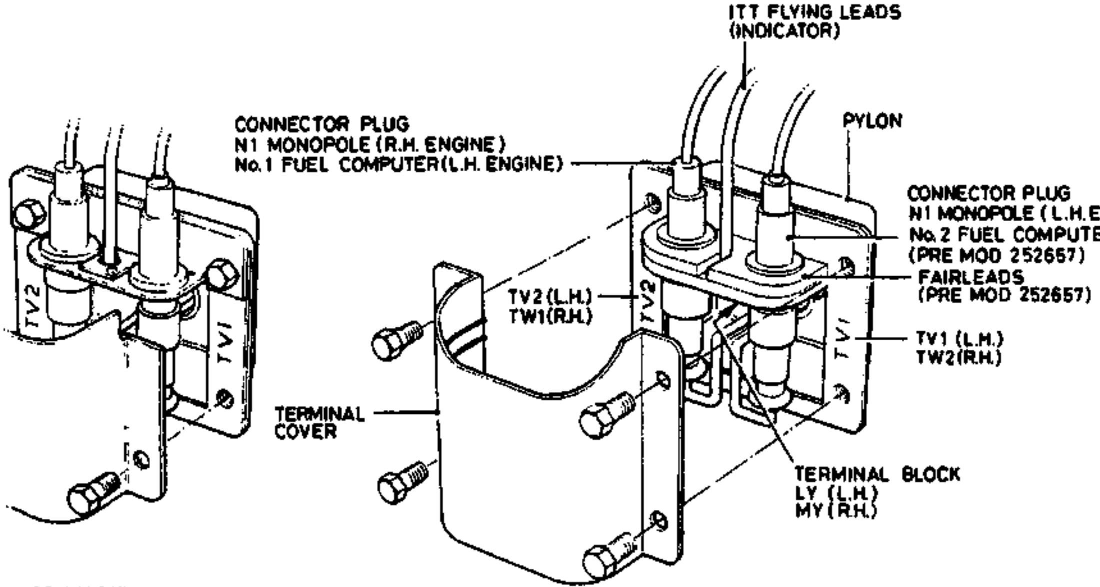
SERVICE CONNECTIONS

A. NI MONOPOLE CONNECTOR PLUG
B. ITT FLYING LEADS-INDICATOR
C. ITT CONNECTOR PLUG No.2 FUEL COMPUTER
D. HIGH PRESSURE AIR BLEED
E. RUDDER BIAS TAPPING PIPE
F. ELECTRICAL CONNECTOR PLUGS
G. LOW PRESSURE AIR BLEED
H. ENGINE THROTTLE TELEFLEX CONTROL
I. PT2 TAPPING PIPE
J. FUEL PIPE HOSE
K. HYDRAULIC HOSES
L. STARTER/GENERATOR CABLES
M. AC GENERATOR CABLE

Power plant services connections - right engine
*Figure B401 (Sheet 2 of 2)*


TV2
TV1
LOW PRESSURE AIR CONNECTOR (REF)
PYLON
LEFT
TA1 TB1
TA2 TB2
TA3 TB3
ELECTRICAL HARNESS CONNECTORS

I.T.T. TERMINAL BLOCK (MOD.252800)
L.H. INSTALLATION SHOWN, R.H. OPPOSITE.
CONNECTIONS AS SHOWN IN VIEW BELOW.


ITT FLYING LEADS (INDICATOR)
CONNECTOR PLUG N1 MONOPOLE (R.H. ENGINE) No.1 FUEL COMPUTER (L.H. ENGINE)
PYLON
CONNECTOR PLUG N1 MONOPOLE (L.H.ENGINE) No.2 FUEL COMPUTER (PRE MOD 252657)
FAIRLEADS (PRE MOD 252657)
TV2 (L.H.) TW1 (R.H.)
TV1 (L.H.) TW2 (R.H.)
TV2
TV1
TERMINAL COVER
TERMINAL BLOCK LY (L.H.) MY (R.H.)

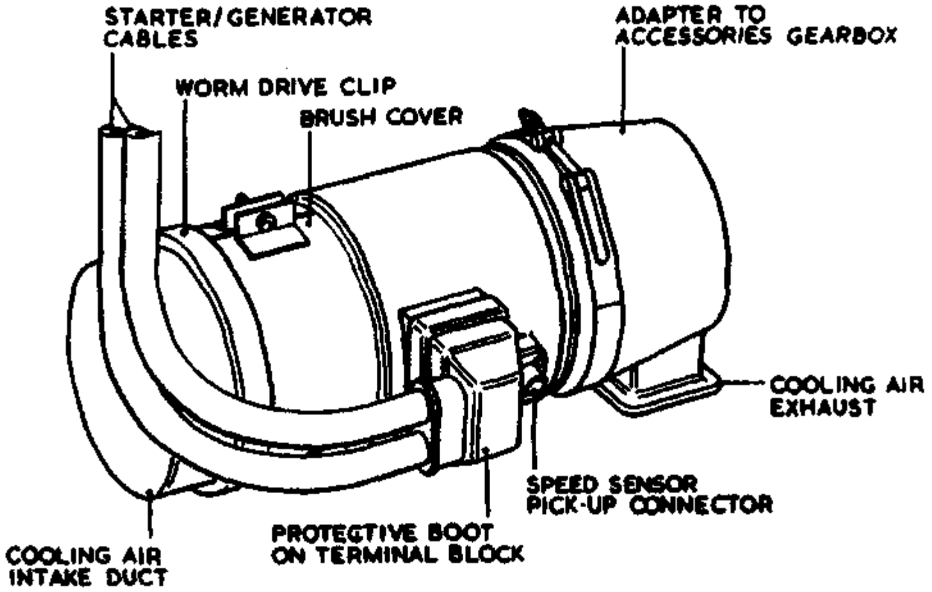
MOD 252657
PRE-MOD 252800

ITT TERMINAL BLOCK

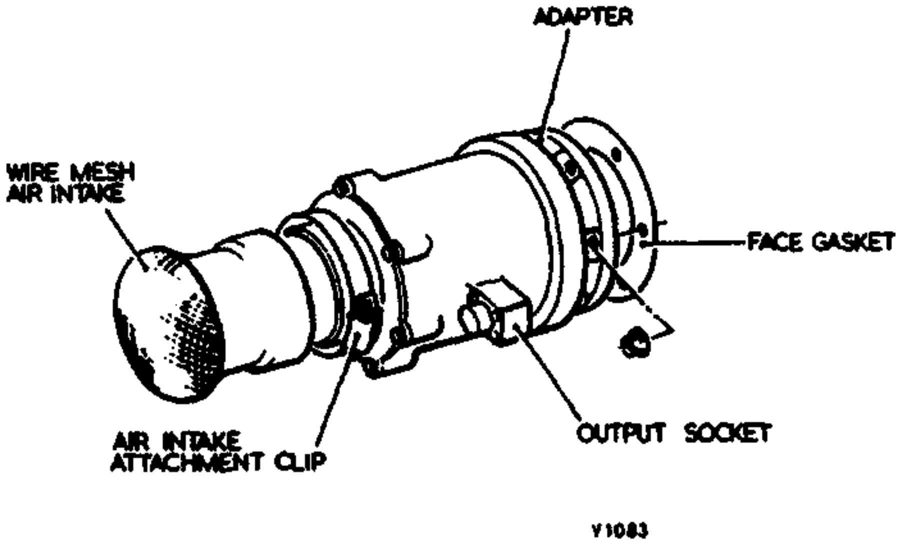
V1073/2

Power plant services connections details - electrical

*Figure B402*

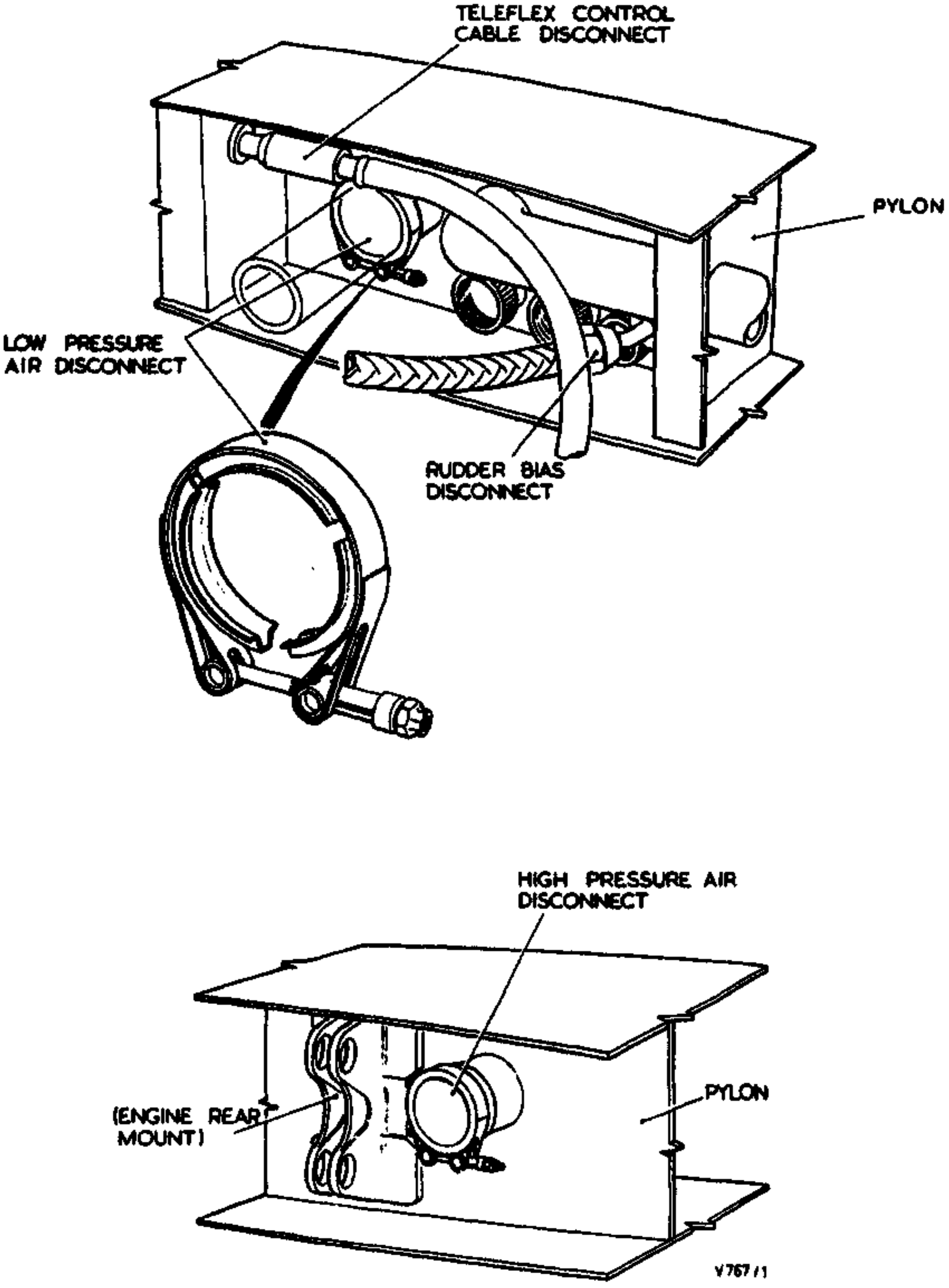

STARTER/GENERATOR CABLES
WORM DRIVE CLIP
BRUSH COVER
ADAPTER TO ACCESSORIES GEARBOX
COOLING AIR EXHAUST
SPEED SENSOR PICK-UP CONNECTOR
PROTECTIVE BOOT ON TERMINAL BLOCK
COOLING AIR INTAKE DUCT

STARTER / GENERATOR



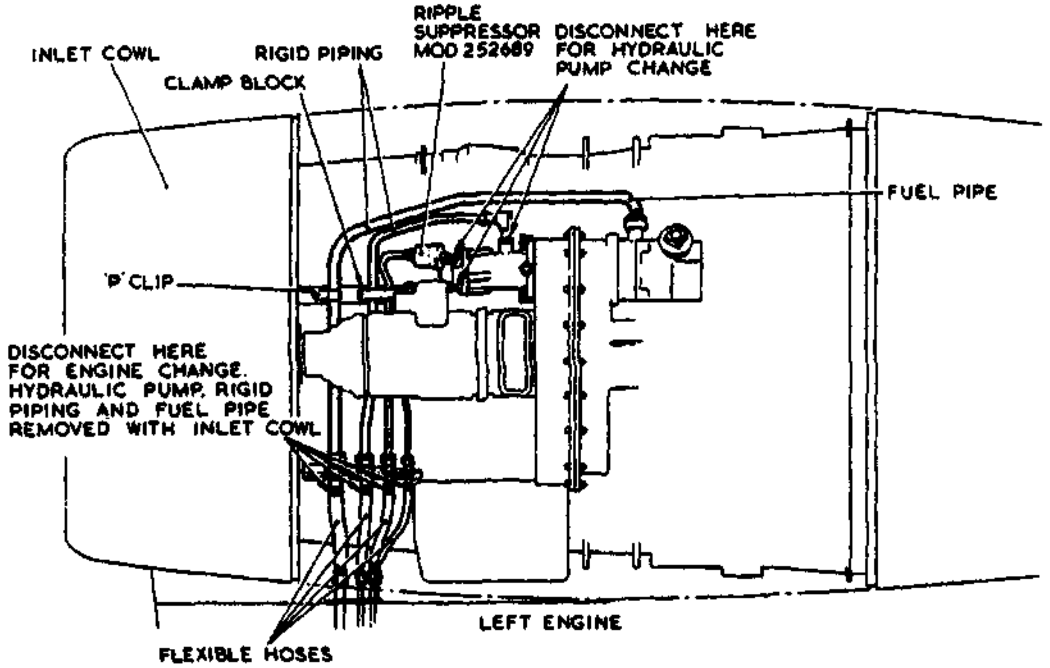
AC GENERATOR

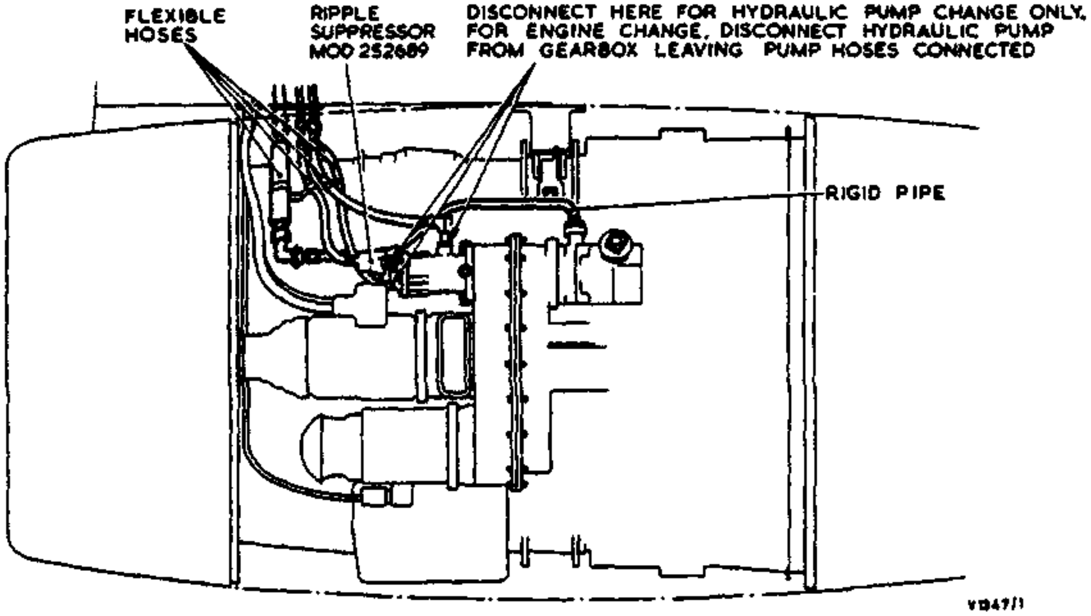
Power plant generators - Connection details
*Figure B403*


TELEFLEX CONTROL CABLE DISCONNECT
PYLON
LOW PRESSURE AIR DISCONNECT
RUDDER BIAS DISCONNECT
HIGH PRESSURE AIR DISCONNECT
(ENGINE REAR MOUNT)
PYLON
V767/1

Power plant services connection details - Mechanical

*Figure B404 (Sheet 1 of 2)*


RIPPLE SUPPRESSOR MOD 252689
DISCONNECT HERE FOR HYDRAULIC PUMP CHANGE
INLET COWL
RIGID PIPING
CLAMP BLOCK
FUEL PIPE
'P' CLIP
DISCONNECT HERE FOR ENGINE CHANGE. HYDRAULIC PUMP, RIGID PIPING AND FUEL PIPE REMOVED WITH INLET COWL
LEFT ENGINE
FLEXIBLE HOSES


FLEXIBLE HOSES
RIPPLE SUPPRESSOR MOD 252689
DISCONNECT HERE FOR HYDRAULIC PUMP CHANGE ONLY. FOR ENGINE CHANGE, DISCONNECT HYDRAULIC PUMP FROM GEARBOX LEAVING PUMP HOSES CONNECTED
RIGID PIPE
V1047/1

RIGHT ENGINE

Power plant services connection details - Mechanical
*Figure B404 (Sheet 2 of 2)*

(6) Disconnect hydraulic/fuel pipes:

(a) Disconnect flexible pipes at the pylon interface.

(b) Allow residual fuel and fluid to drain off into a container.

(c) Blank off flexible and rigid pipes.

**D. Remove power plant from aircraft**

(1) Prepare and suitably position power plant stand to receive removed engine.

(2) Position the hoisting equipment.

(3) Attach power plant sling to hook of hoisting equipment.

(4) Connect sling to the front and rear slinging points as shown on *Figure B405.*

*NOTE: When slinging a power plant (complete with aft cowl assembly) and the TA1 harness (left engine) or TB1 harness (right engine) has not been locally re-routed, it will necessitate insertion of the rear slinging point quick-release pin from the forward side. To achieve a forward insertion of the pin, the engine harness must first be eased away from the pin location by disconnecting the adjacent attachment P-clip together with the next clip on each side.*

(5) Remove all extraneous tools and gear from the work area.

**CAUTION: NOW MAKE SURE THAT THE ENGINE MOUNTS ARE THE ONLY CONNECTION BETWEEN THE PYLON AND ENGINE.**

(6) Take the initial weight of the engine with the hoisting equipment.

(7) Disconnect engine rear mount *(Figure B406)*:

(a) Remove split pins, nuts, washers, bushes and bolts (5) from the engine attachment lug. Discard the split pins.

(8) Disconnect the engine front mount link from the bottom attachment assembly:

(a) Remove the split pin, nut and washers from bolt (2). Discard the split pin.

(b) Remove bolt (2), with special thick washer under head, as the weight of the engine is being taken. Extract short and long bushes.

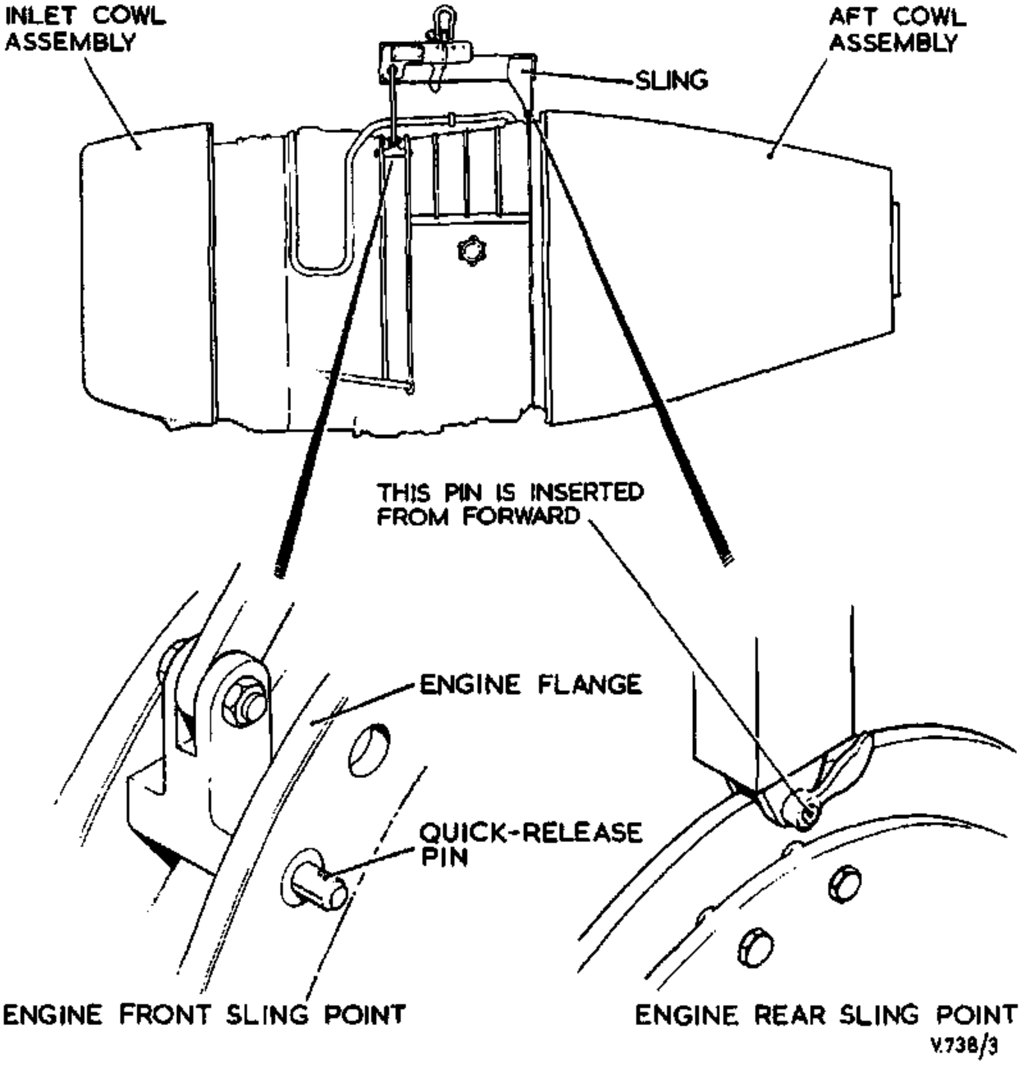
(9) Disconnect engine front mount top attachment from the pylon yoke:

(a) Remove split pin from attachment nut. Discard split pin.

(b) Remove slotted nut, standard washers and special thick washer.

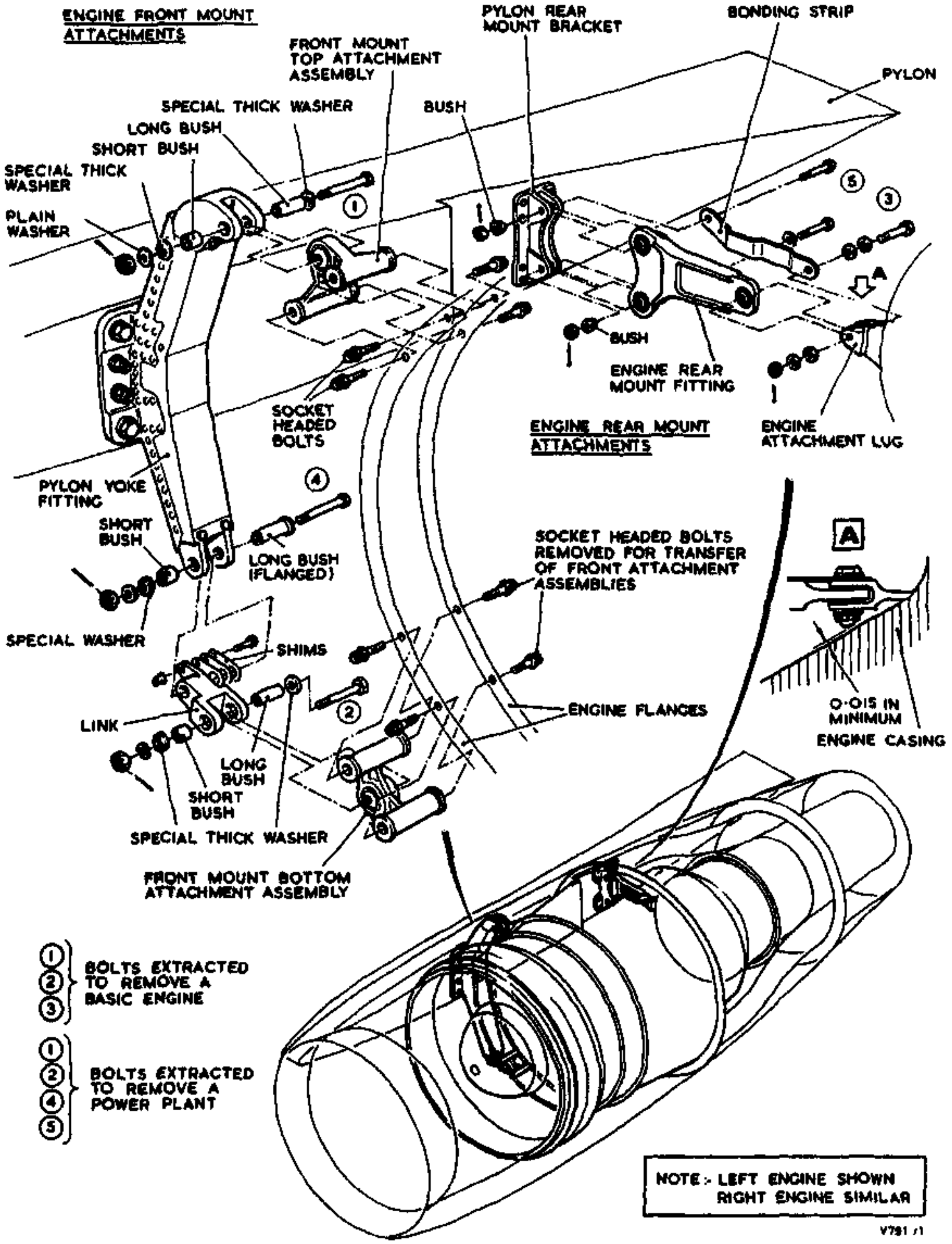
(c) Withdraw bolt (1) leaving the special thick washer under the head. Extract short and long bushes.

(10) Ease the engine outboard clear of the pylon.



Engine sling

*Figure B405*


ENGINE FRONT MOUNT ATTACHMENTS
FRONT MOUNT TOP ATTACHMENT ASSEMBLY
PYLON REAR MOUNT BRACKET
BONDING STRIP
PYLON
SPECIAL THICK WASHER
BUSH
LONG BUSH
SHORT BUSH
SPECIAL THICK WASHER
PLAIN WASHER
⑤
③
①
A
BUSH
ENGINE REAR MOUNT FITTING
SOCKET HEADED BOLTS
ENGINE REAR MOUNT ATTACHMENTS
ENGINE ATTACHMENT LUG
PYLON YOKE FITTING
④
SHORT BUSH
LONG BUSH (FLANGED)
SOCKET HEADED BOLTS REMOVED FOR TRANSFER OF FRONT ATTACHMENT ASSEMBLIES
A
SPECIAL WASHER
SHIMS
LINK
②
ENGINE FLANGES
O·O15 IN MINIMUM
ENGINE CASING
LONG BUSH
SHORT BUSH
SPECIAL THICK WASHER
FRONT MOUNT BOTTOM ATTACHMENT ASSEMBLY
① ② ③ BOLTS EXTRACTED TO REMOVE A BASIC ENGINE
① ② ④ ⑤ BOLTS EXTRACTED TO REMOVE A POWER PLANT
NOTE:- LEFT ENGINE SHOWN RIGHT ENGINE SIMILAR
V791 /1

Power plant mount details

*Figure B406*

(11) Lower the engine on to the stand and secure.

*NOTE: Seal off any remaining apertures on the removed power plant.*

**Table B401 (Series F400)
ENGINES - POWER SUPPLIES**

| Circuit | | Sub-panel D - circuit breaker | Sub-panel E - circuit breaker | Panel ZK - fuse | Panel ZL - fuse |
|---|---|---|---|---|---|
| Fuel filter | Left<br>Right | -<br>- | -<br>- | -<br>- | F16<br>F17 |
| Fuel temperature | Left<br>Right | -<br>- | -<br>- | -<br>- | F18<br>F19 |
| Oil low pressure | Left<br>Right | -<br>- | -<br>- | -<br>- | F21<br>F22 |
| Oil temperature | Left<br>Right | -<br>- | B21<br>B22 | -<br>- | -<br>- |
| Oil pressure | Left<br>Right | B15<br>B16 | -<br>- | -<br>- | -<br>- |
| Fuel flowmeter | Left<br>Right | -<br>- | -<br>- | F38, F39<br>F38, F48 | -<br>- |
| Fire detection | Left<br>Right | -<br>B22 | -<br>- | -<br>- | F12<br>F11 |
| Engine/intake de-ice | Left<br>Right | B50<br>B51 | -<br>- | F24<br>F25 | -<br>- |
| Engine r.p.m. | Left<br>Right | -<br>- | -<br>- | F34, F35, F44, F45<br>F29, F30, F54, F55 | -<br>- |
| I.T.T. | Left<br>Right | -<br>- | -<br>- | F28<br>F28 | -<br>- |
| Ignition | Left<br>Right | -<br>- | -<br>- | -<br>- | F5<br>F6 |
| No.1 fuel computer | | - | - | F10, F31 | - |
| No.2 fuel computer | | - | - | F11, F20, F32 | - |

## 2. Install power plant

| Equipment/Material | Part/Item No. |
|---|---|
| Power plant sling | 25-7Y9-A |
| Power plant stand | 25-7Y-25A or equivalent |
| Strap wrench capable of applying torque (lbf in.) Part No.TG-65-1 thru TG-65-7 | 120-130 |
| Torque wrench capable of (lbf in.) | (a) 15-16 1/2<br>(b) 35-40<br>(c) 60-85<br>(d) 100<br>(e) 120-130<br>(f) 160-190<br>(g) 185-215 |

| Materials | Application |
|---|---|
| Grease, Aeroshell 17 or any grease specified in Allied Signal, Light Maintenance Manual Report No. 72-02-15 | Accessory gearbox front drive splines and all bolts and bushes associated with the engine front mountings |
| Engine oil | Non-engine nuts to be torque loaded |
| Fel-Pro C5A<br>Neverseez NSN165B | Pipe/hose coupling threads and engine rear mount bolt (3) *(refer to Figure A411)* |

| Nomenclature | Part No. | Alternative | Location | Qty |
|---|---|---|---|---|
| Split pin | SP90-E10 | – | Engine mounts | 1 |
| Split pin | MS 24665-231 | SP90-D8 | Engine mounts | 1 |
| Split pin | MS 24665-302 | SP90-E8 | Engine mounts | 2 |

### A. Prepare to install power plant

(1) Torque loadings:

(a) All torque loading figures quoted are the actual loadings required.

If an extension spanner is used between the torque spanner and the item being tightened, calculate the correct torque spanner dial reading required using the following expression:

$$R = \frac{T \times L}{L + E}$$

Where R = Indicated value on torque wrench

T = Actual torque value
L = Effective length of torque lever arm
E = Effective length of offset

(b) Unless otherwise specified, nuts which are part of the basic engine as supplied by Garrett AiResearch, are torque loaded with dry threads, (no lubricant).

(c) Unless otherwise stated, certain nuts used for the assembly of items of equipment installed to build an engine up to power plant standard are torque loaded with wet threads *i.e.* engine oil lightly applied prior to the application of a specified torque load.

(2) Cleanliness:

(a) Remove any foreign matter which may have accumulated on the cowlings or pylon.

(3) Self-locking nuts:

(a) Garrett AiResearch supply nuts - Do not re-use.

(b) Other than Garrett AiResearch supply nuts - Check the run down torque manually.

Attempt to screw the self-locking nut on the bolt or stud beyond the locking section using maximum finger pressure. If the nut can be screwed beyond the locking section reject it. Select a new nut and repeat the check until satisfactory.

(c) General - During final assembly of self-locking nuts (after torque-tightening), check to make sure that a minimum of one full thread (in addition to the chamfered portion of the bolt or stud end) is protruding beyond the outer face of the nut.

(4) The technique for connecting V-clamp type joints is:

(a) Lightly lubricate the V-clamp abutment and pipe flanges.

(b) Install and connect pipe joint clamp and torque tighten to the specified value.

(c) Loosen the clamp one 1/2 turn.

(d) Retorque to the specified value.

(e) Repeat (c) and (d) until the clamp bolt ceases to advance.

**B. Connect slinging equipment** *(Figure B405)*

(1) Connect the sling to the power plant.

(2) Connect sling to hoisting equipment and take weight of the power plant.

(3) Release power plant stand attachments.

**C. Install power plant** *(Figure B406)*

(1) Hoist the engine and carefully manoeuvre it toward the aircraft until the engine front top and rear mounts align with their airframe counterparts.

(2) Make sure pylon pressurization pipe is correctly seated in the pylon interface.

(3) Connect the engine front mount top attachment assembly to the mounting yoke:

(a) Align the attachment assembly with the yoke fork, lightly lubricate the long and short bushes (refer to Materials). Insert the long bush from the rear and short bush from the front.

(b) Lubricate the attachment bolt, complete with special thick washer (refer to Materials), insert and push fully home.

(c) Install a special thick washer, plain washer and slotted nut in that order.

(d) Torque tighten the slotted nut to 160-190 lbf in. making sure the split pin hole aligns.

*NOTE: Should it be advantageous to apply tightening torque by way of the bolt, apply 185-215 lbf in. with the nut restrained.*

(e) Install and lock a new split pin.

(4) Connect the engine front bottom mount attachment assembly to the link:

(a) Rotate the link until its bolt hole aligns with the spherical bush in the bottom attachment assembly.

(b) Lubricate the long and short bushes (refer to Materials). Insert the long bush from the rear and short bush from the front.

(c) Lubricate the engine rear attachment bolts (refer to Materials). Insert the top and bottom bushes from the front then insert bolts from the rear.

(d) Lubricate the bottom mount bolt (refer to Materials) and insert bolt complete with washers under the head.

(e) Install a special thick washer and plain washer and slotted nut. Make sure the nut is not thread-bound.

(f) Torque tighten the slotted nut to 160-190 lbf in. making sure the split pin hole aligns.

*NOTE: Should it be advantageous to apply tightening torque to the bolt, apply 185-215 lbf in. with the nut restrained.*

(g) Install and lock a new split pin.

(5) Complete the engine rear mount attachment:

(a) Install slotted nuts to the upper and lower bolts.

(b) Torque tighten the nuts to 60-85 lbf in. making sure the split pin hole aligns.

(c) Install and lock new split pins.

(6) Disconnect and remove engine sling. Reconnect harness P-clips adjacent to the rear slinging point if disconnected.

**D. Installation of components and connection of services** *(Figures B401, B402 and B403)*

(1) Connect N1 and ITT services:

(a) Connect the ITT indicator cable red sleeved idented lead to terminal LY2 of terminal block LY (left engine) and the yellow sleeved lead to terminal LY1 or the red sleeved lead to terminal MY2 of terminal block MY (right engine) and the yellow sleeved lead to terminal MY1 i.e., engine red sleeved lead to aircraft blue sleeved lead and engine yellow sleeved lead to aircraft red sleeved lead. Post-Mod.252657 pull cable through hole in mounting bracket.

(b) Pre-Mod.252657 only: install fairleads.

(c) Connect the N1 monopole coded TV1 (left engine) or TW1 (right engine).

(d) Connect the ITT computer plug, coded TV2 (left engine) or TW2 (right engine).

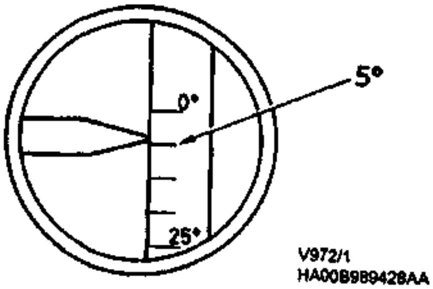
(e) Install terminal block cover and terminal cover.

(2) Install Teleflex control:

(a) Make sure that the high pressure fuel cock control lever is caged OFF.

(b) Check reading of power scheduling indicator on fuel control unit. *(Figure B407)*

*NOTE: Since the high pressure fuel cock control system rigging has not been disturbed, the indicator reading should be within 5 degrees of zero.*



*Engine power scheduling indicator*
*Figure B407*

(c) Remove cap from end of fuel control unit.

(d) Locate the Teleflex box on the fuel control unit power shaft, install three attachment bolts and torque tighten bolts to 15-16 1/2 lbf/in. Wire-lock bolt heads.

*NOTE: For FCU power lever shaft protractor angles, refer to Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, Page block 401.*

(e) Connect Teleflex control mounting brackets to aft cowl assembly attachment flange and tighten nuts.

(3) Engine connections - Pre-Mod.252779

(a) Before connecting starter/generator heavy duty cables, check that cable protrusion from fairlead (*Figure B408* - left engine or *Figure B409* - right engine) at pylon interface is:

| | |
|---|---|
| Left engine | |
| +ve cable = 3ft 2.0 in. | from pylon fairlead to centre of cable lug eye-end, |
| -ve cable = 3ft 2.5 in. | measured in a straight line. |
| Right engine | |
| +ve cable = 2ft 6.5 in. | from pylon fairlead to centre of cable lug eye-end, |
| -ve cable = 2ft 7.0 in. | measured in a straight line. |

*NOTE: If cable protrusion is correct, proceed as in operation (b). If the protrusion is not correct, embody Mod.252779 (new shorter cables incorporating SHRUNK-ON sleeves to define correct protrusion).*

(b) Route and clamp/clip-up starter/generator and a.c. generator cables.

(c) Connect output socket to a.c. generator and locally clip cables.

(4) Engine connections - Mod.252779.

(a) Before connecting starter/generator heavy duty cables, make sure that the cable locating sleeves abut the pylon fairlead.

(b) Do paragraphs (3) (b) and (c).

(5) Connect starter/generator light and heavy duty cables:

(a) Attach heavy duty cables to terminal block. Install washers and nuts.

(b) Torque tighten nuts to 100 lbf in.

(c) Roll cable rubber boot to cover terminal block.

(d) Connect light duty cables.

(e) Connect speed sensor cable to socket on starter/generator.

(f) Aircraft Pre-Mod.252779 - Re-install TY9 cable strappings at the positions previously vacated.

(g) Aircraft with Mod.252779 - Re-install LK3 cable strappings at the positions shown in *Figure B408* - left engine or *Figure B409* - right engine.

(6) Connect remaining services at pylon interface:

(a) Remove caps from the PT2/TT2 pipe and its counterpart. Connect PT2/TT2 pipe. Tighten and wire-lock.

(b) Remove caps from flexible fuel pipe and its rigid counterpart. Connect fuel pipe, tighten and wire-lock.

(c) Left engine only - Remove caps from hydraulic flexible pipes and their rigid counterparts. Connect pipes, tighten and wire-lock.

(d) Remove cap from rudder bias pipe and its counterpart. Connect, tighten and wire-lock pipe.

(e) Connect TA1, TA2, TA3 harness connectors (left engine) or TB1, TB2, TB3 harness connectors (right engine) at the pylon interface and wire-lock the connectors.

*NOTE: The TA2 or TB2 harness plug P12 is torque tightened to 120-130 lbf in. using a strap wrench (refer to Equipment required).*

(f) At the low pressure air connector to mixer valve pipe joint, lubricate the abutment faces of the joint clamp (refer to Materials). Install and connect the clamp. Torque tighten the clamp nut to 35-45 lbf in.

(g) Make sure caps are removed from the high pressure air bleed, lightly lubricate pipe flanges and clamp abutment faces (refer to Materials). Install and connect pipe joint clamp. Torque tighten clamp closing nut to 35-45 lbf in.

(7) Restore integrity of electrical circuits. Install fuses and close circuit breakers (Table B401).

(8) Make sure that Garrett SB.TFE731-73-3107 (BAe Mod.253280A, SB.73-23-3280A - To provide additional support for engine fuel pipe) has been embodied on this engine.

**E. Post installation, procedures**

*NOTE: Do not install the upper panel, lower access door around engine Zone 1 and the access panels in the pylon upper and lower surfaces until the Post installation procedures have been satisfactorily concluded.*

(1) Left engine only - Prime hydraulic pump:

(a) Make sure the hydraulic reservoir is full.

(b) Remove vent plug from top of pump.

(c) Remove notice and set the appropriate high pressure fuel cock lever to ON.

(d) When there is a free flow of fluid from the vent, return the high pressure fuel cock lever to OFF.

(e) Re-install, tighten and wire-lock the vent plug.

(f) At the next engine run, do a check for leaks at the vent plug.

(2) Ground test the engine - Chapter 71-00-00 - POWER PLANT - ADJUSTMENT/TEST.

**F. Close up**

(1) Install the top and bottom outer panels to the aft cowl assembly at the engine rear mount.

(2) Install upper panel:

(a) Locate the panel on the engine and make sure that its hinge bars do not damage local electrical cables.

(b) Align bolt holes (3 off) at the forward edge of the panel and install securing bolts but do not tighten at this stage.

(c) Align the panel shear pins (2 off) with their assembly housings on the aft cowl assembly and close the shear pin latches.

(d) Tighten the panel securing bolts installed in paragraph (b).

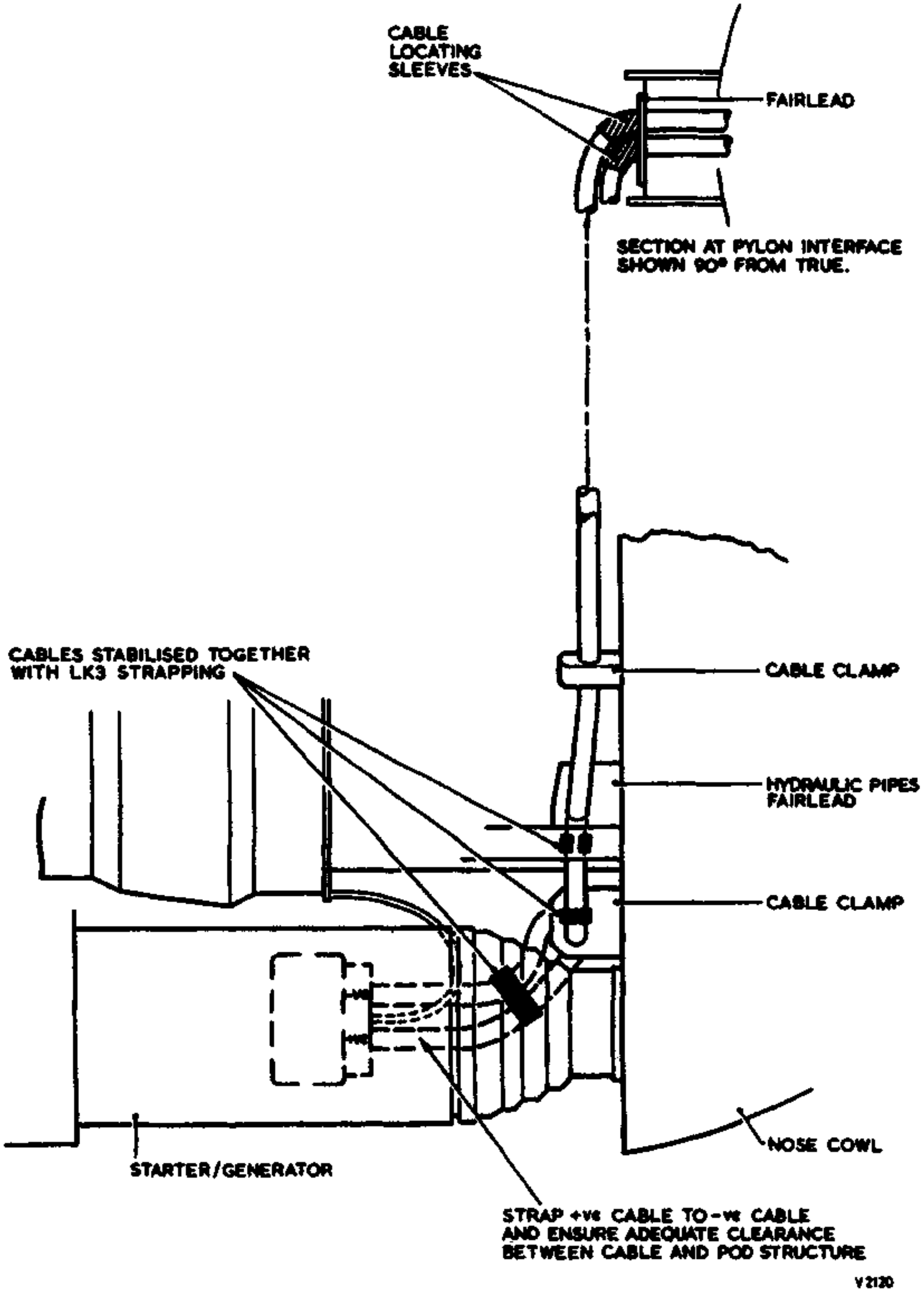
(3) Install lower access door:

(a) Position the door up to the hinge bars on the upper panel. Close the hinge latches and make sure that they seat flush.

(b) Close the door, push in the latches and make sure that they seat flush.

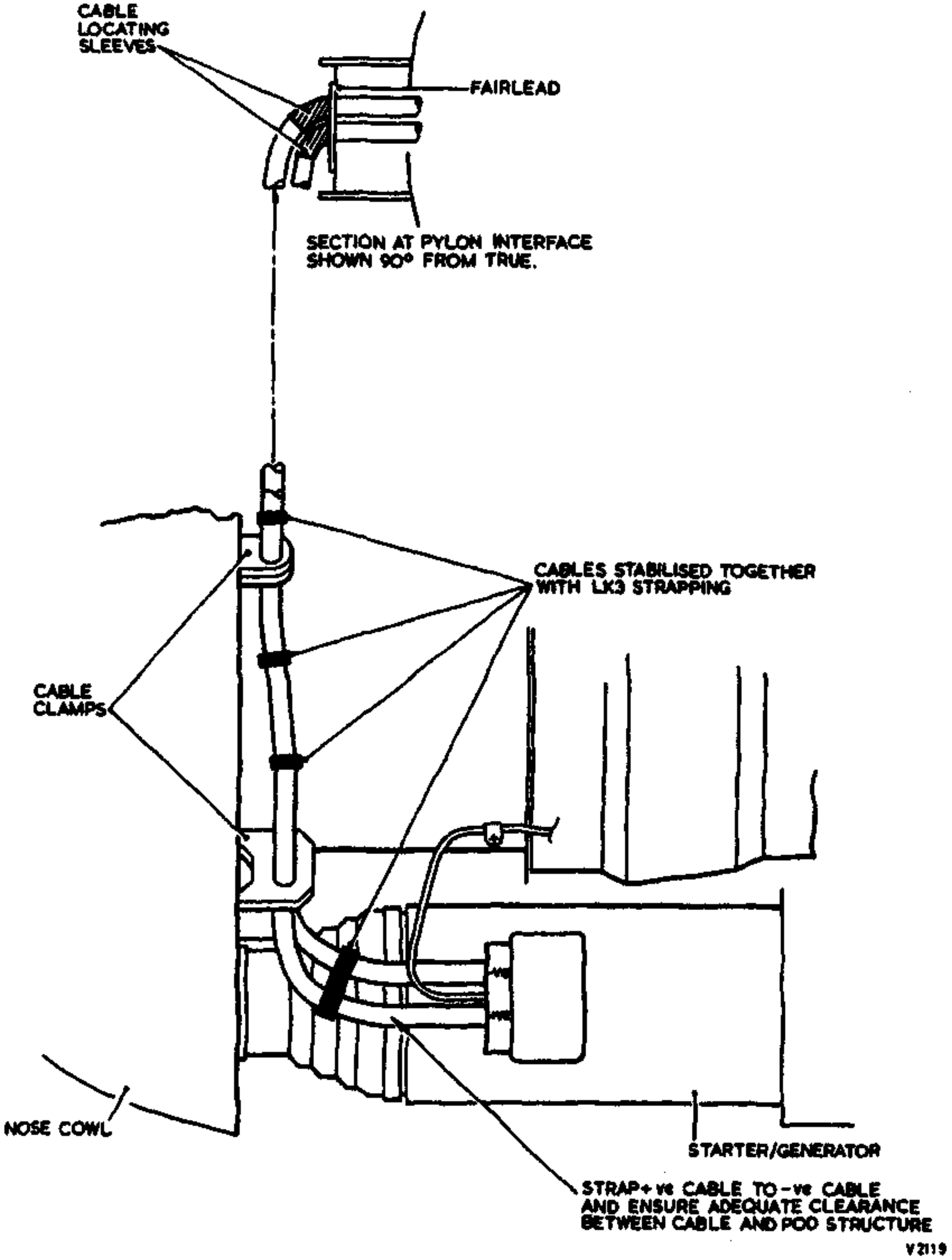
(c) Make sure the engine breather pipe seal on the inner face of door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

**CAUTION: SHOULD THE OBSTRUCTION BE IN EXCESS OF 50%, RENEW THE SEAL (REFER TO CHAPTER 71-10-00 SERVICING).**


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMP
HYDRAULIC PIPES FAIRLEAD
CABLE CLAMP
NOSE COWL
STARTER/GENERATOR
STRAP +ve CABLE TO -ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2120

Location of starter/generator heavy duty cables Mod.252779 left engine

*Figure B408*


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMPS
NOSE COWL
STARTER/GENERATOR
STRAP+ve CABLE TO-ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2119

Layout of starter/generator heavy duty cables Mod.252779 right engine

*Figure B409*

# POWER PLANT
# ADJUSTMENT/TEST

**WARNING: THE GROUND RUNNING OF AIRPLANE ENGINES MUST AT ALL TIMES BE PERFORMED IN ACCORDANCE WITH THE SPECIFIED PROCEDURES.**

**WARNING: WHENEVER POSSIBLE, THE GROUND RUNNING OF ENGINES, FOR TEST OR CALIBRATION PURPOSES, MUST BE PERFORMED AT A DESIGNATED GROUND RUNNING BASE.**

**WARNING: ALL GROUND RUNNING ACTIVITIES ARE TO BE ADMINISTERED BY A COMPETENT SUPERVISOR VESTED WITH THE RESPONSIBILITY TO MAKE SURE OF COMPLIANCE WITH THE SPECIFIED PROCEDURES.**

**WARNING: THE SUPERVISOR WILL MAKE SURE THAT ANY EQUIPMENT USED FOR STARTING ENGINES IS IN A SERVICEABLE CONDITION.**

## 1. Ground running - General procedures

### A. Preliminary actions prior to ground running.

**CAUTION: BEFORE STARTING THE ENGINES, THE SUPERVISOR MUST MAKE SURE OF THE FOLLOWING:**

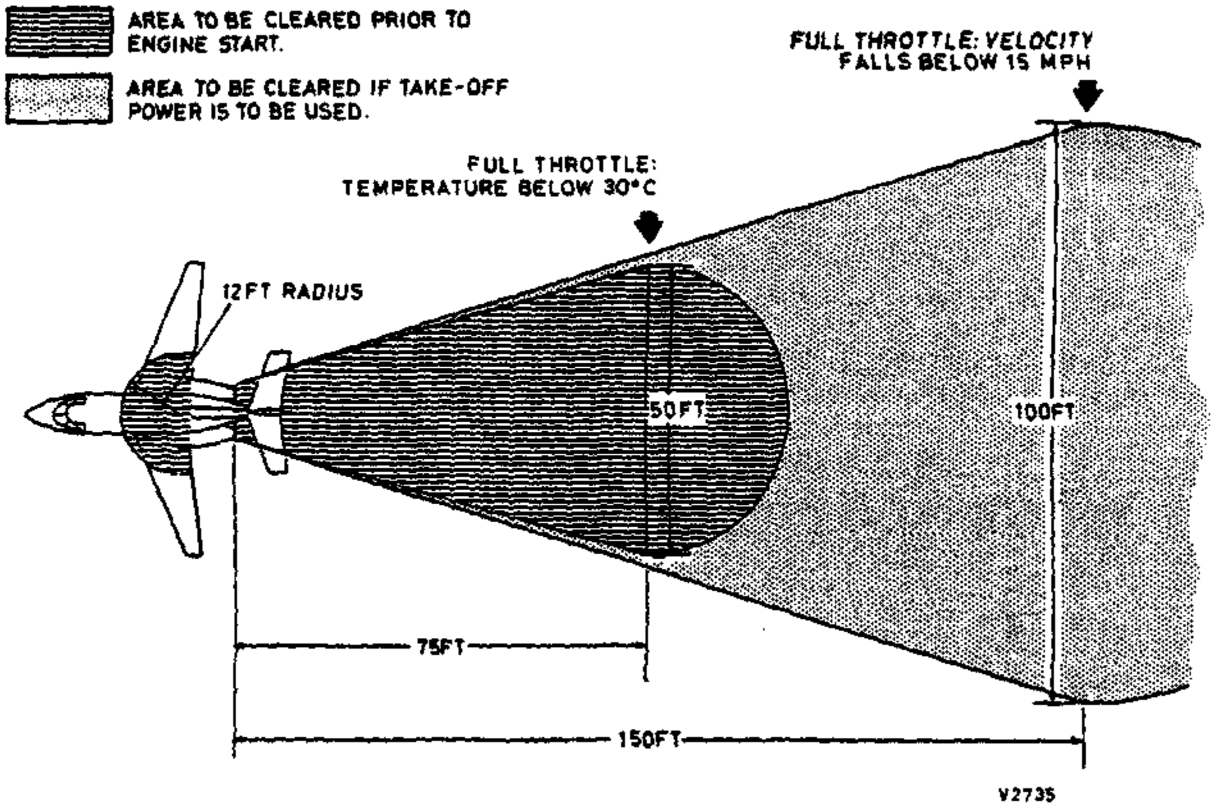
- **THE AIRPLANE IS PROPERLY RESTRAINED.**
- **THE ENGINES ARE AT THE CORRECT STANDARD FOR STARTING**
- **DOORS AND PANELS ARE PROPERLY CLOSED. ANY DOORS REQUIRED TO BE OPEN DURING THE GROUND RUN MUST BE SUPPORTED.**
- **THE AIRPLANE IS PROPERLY GROUNDED.**

(1) Position the airplane (preferably headed into wind) and standing on concrete free from cracks, joints, debris, dust and free from fuel and/or oil contamination, so that all buildings etc. which will be in line with the jet efflux are clear of the danger areas (*Figure 501*).

(2) Centralize nose gear and chock the wheels; if the airplane is to stand unattended chock the wheels fore and aft and lash the chocks together.

(3) Make sure the landing gear lock pins and steering disconnect pin are installed. When not in use the locking pins are stowed in the forward vestibule cabinet.

(4) Position serviceable fire fighting equipment adjacent to the airplane; this equipment must be of the mobile type, having not less than two separate cylinders coupled to a remote discharge nozzle. Each cylinder must contain not less that 10 lb. of extinguishant, such as BCF (bromochlorodifluoromethane) or $CO_2$ and be capable of being discharged individually.


AREA TO BE CLEARED PRIOR TO ENGINE START.
AREA TO BE CLEARED IF TAKE-OFF POWER IS TO BE USED.
FULL THROTTLE: VELOCITY FALLS BELOW 15 MPH
FULL THROTTLE: TEMPERATURE BELOW 30°C
12FT RADIUS
50FT
100FT
75FT
150FT
V2735

Danger areas
*Figure 501*

**WARNING: ALL PERSONNEL MUST AVOID DANGER AREAS TO THE FRONT AND REAR OF JET ENGINES DURING GROUND RUNNING OPERATIONS.**

**WARNING: A JET ENGINE IS CAPABLE OF DEVELOPING SUFFICIENT SUCTION TO PULL PERSONNEL INTO THE INTAKE WITH POSSIBLE FATAL RESULTS OR SERIOUS INJURY.**

**WARNING: THE SUCTION NEAR THE INTAKE CAN ALSO PULL IN HATS, GLASSES, SCARVES OR LOOSE FITTING CLOTHING, INCLUDING UNSECURED JACKETS OR HOODS.**

**WARNING: ANY LOOSE ARTICLES OR CLOTHING MUST BE MADE SECURE OR REMOVED BEFORE APPROACHING OR WORKING ON A GROUND RUNNING JET ENGINE.**

(5) Clear the danger areas (*Figure 501*) of all loose equipment etc.

(6) Remove all covers and blanks from engine intakes, exhausts and pitot heads.

(7) Make sure the engine intakes and exhausts are free from foreign matter.

(8) Make sure that the airplane has serviceable internal batteries installed and connected.

(9) Position a suitable external electrical power supply adjacent to the airplane, if available, or use the airplane APU (Chapter 49, AIRBORNE AUXILIARY POWER).

*NOTE: Only use an external power supply which is installed with a 1100 amp current limiter.*

*NOTE: A 28-volt generator starting set, having voltage regulation, is the ideal piece of ground equipment; with this set, a voltage range of between 26 to 30 volts is acceptable. A 24-volt battery trolley is unlikely to be capable of meeting the engine starting demand. An unregulated 28-volt transformer/rectifier starting set, provided it does not suffer a high voltage drop, may be satisfactory.*

(10) Unless electrical power supplies have been established, either with the APU or D.C. ground supply, Make sure the electrical power switches are as follows:

| | |
|---|---|
| BATT | OFF |
| EXT PWR | OFF |
| INV 1 and 2 | STOP |
| STBY INV | OFF |

(11) Refer to Allied Signal Light Maintenance Manual Report No. 72-02-15, Chapter 72, ENGINE - ADJUSTMENT/TEST as necessary, for details of data and/or equipment required for ground testing engines.

### B. Safety precautions during engine running

**WARNING: DO NOT ENTER DANGER AREAS (*Figure 501*) WHEN WORKING ON ENGINES.**

(1) Do not wear hats or loose clothing when working on, or in the vicinity of running engine(s).

(2) Wear ear protectors when working on, or in the vicinity of, running engines.

(3) When running engines during ground pressurization tests, all persons involved must be aware of the effect of an emergency depressurization.

(4) The supervisor must be positioned so that he can observe personnel carrying out adjustments to an engine during ground running.

(5) Personnel must be attentive at all times to the supervisor for signals which may be necessary for their safety.

*NOTE: Only personnel concerned with ground running, and authorized by the supervisor to be in attendance are allowed to approach the airplane. Notices must be erected at approaches to the airplane giving warning that ground running is in progress.*

### C. Engine handling

(1) Rear equipment bay: During ground running make sure of access to the rear equipment bay.

(2) Intercommunication system (Intercom)
During ground running, when adjusting or testing the installation the intercom system may be used to maintain close liaison between the ground and the flight compartment. There is an intercom jack box in the nose landing gear bay.

(3) Cold start selection (if installed) - Internal power start only.
If the airplane has been subject to a cold soak for more than 6 hours at less than 0°C., select COLD START during starting of the first engine. Do not select COLD START for starting the second engine if the first is still running.

(4) Fuel enrichment selection
Fuel enrichment is applied automatically with the computer up to 400°C. inlet turbine temperature (I.T.T.).

When starting during extremely cold situation (-18°C. or lower), if an engine is slow to accelerate, intermittently operate the number 1 or 2 FUEL ENRICH button to obtain satisfactory acceleration. Carefully monitor I.T.T. Fuel enrichment is inoperative during manual mode starting.

(5) Engine starting - Computer mode
Manual mode starts are considered an abnormal method of operation and are approved only for the completion of a flight or an airplane despatch to an authorized service center. After engine shutdown, computers must be selected to manual mode.

(6) Icing conditions
At ambient temperature of 5°C. and below, combined with a relative humidity above 60%, select engine anti-icing on for ground running. At temperatures above 5°C. do not operate engine anti-icing for more than 10 seconds.

The use of anti-icing will cause an increase in I.T.T. of approximately 10° to 15°C. at idle rpm.

(7) Fuel filter blockage or fuel overheat warning
If a FUEL FILTER or FUEL O/HEAT warning persists, stop engine.

(8) Hot starts
During starts, to avoid exceeding I.T.T. limitation, if the I.T.T. rises too quickly, exceeds or tends to exceed 907°C., close the HP cock immediately and investigate the cause. If fire is burning within tail pipe area, motor engine to blow out fire immediately after closing HP cock.

Do not attempt to restart the engine until the I.T.T. is less than 200°C.

If the airplane is "tail into wind" the starting I.T.T. will tend to increase.

(9) Abortive starts
If the engine does not light within 10 seconds of opening HP fuel cock, close the HP fuel cock and press PUSH FOR ABORT switch and allow the engine to stop; make sure of the the cause for failure to start. After an abortive start, allow excess fuel to drain from engine for 3 minutes, move airplane clear of any fuel on the ground, or clear fuel from ground before attempting another start.

(10) Cooling starter/generator
After three successive starting cycles, allow the starter/generator to cool for 30 minutes.

(11) Throttling
Operate the throttle slowly and deliberately; (approx. 2-3 seconds from idle to take-off setting) particularly when in manual mode. Keep ground running to a minimum.

(12) Excessive I.T.T. during ground operation
Avoid exceeding the max. limitation, whenever possible, by closing the throttle and/or HP fuel cock. Report and record, in the engine log book, all instances in which the I.T.T. exceeds the limits specified in the Allied Signal Light Maintenance Manual Report No. 72-02-15, Chapter 72, ENGINE - ADJUSTMENT/TEST.

(13) Compressor surge or stall
In the event of a sudden increase in I.T.T. and/or rumbling or pulsations or banging, which could indicate compressor surge, immediately close the HP fuel cock and investigate the cause.

(14) Ground idling
Ambient conditions affect ground idling speed; $N_1$ rpm varies approximately, between 30% at sea level and 35% at 8000 ft.

(15) Cyclic variation of $N_1$ rpm
A normal characteristic of the engine, which may be observed at idle speed, is a cyclic increase and decrease of $N_1$ and $N_2$ rpm, fuel flow and I.T.T.

(16) $N_1$ and $N_2$ roll down time
$N_2$ roll down times can only be timed with reference to the $N_2$ rotor rpm indicator. Observe engine $N_1$ rotor blades to obtain $N_1$ roll down time because it's rpm indicator ceases to indicate before $N_1$ rotor is stationary. Roll down times may vary between engines, investigate any roll down times less than those specified in Allied Signal Light Maintenance Manual Report No. 72-02-15, Chapter 72, ENGINE - ADJUSTMENT/TEST.

(17) Binding or low pressure ($N_1$) rotor
Thermal binding of the low pressure rotor may occur, because of differential cooling of rotor components, if engine restarts are attempted within 20 to 45 minutes after engine shutdown. If an engine restart is required within the time noted above, thermal binding can be avoided by carrying out a brief motoring cycle as follows:

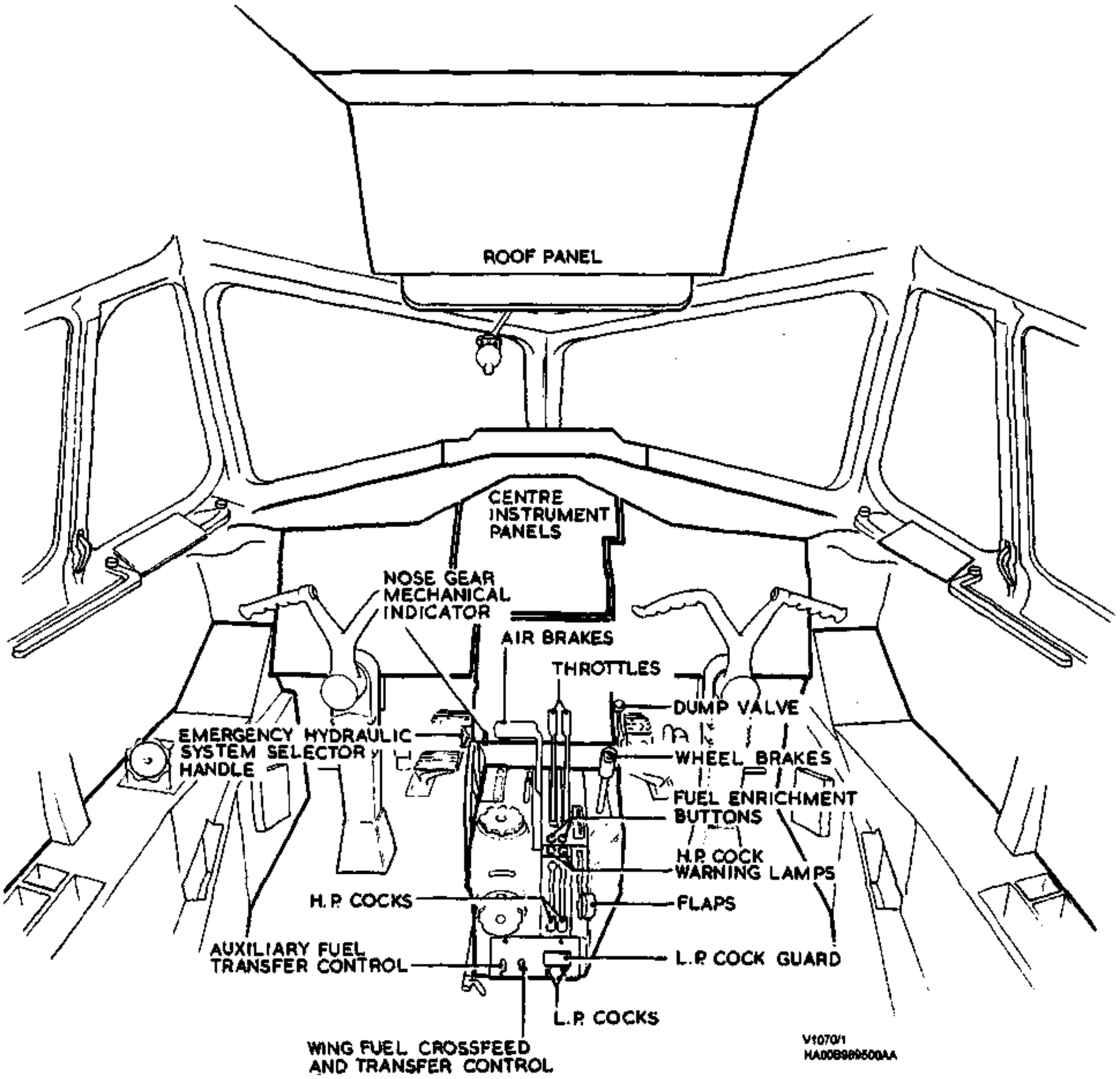
| | |
|---|---|
| HP COCK | Make sure it is closed |
| START PWR switch | Press |
| STARTER switch | Press (release when OPERATING light comes on) |
| $N_1$ rotation | Make sure it is indicated |
| START PWR switch | Push for abort |

(18) Starting order
When starting both engines the normal starting order is engine No.2, engine No.1.

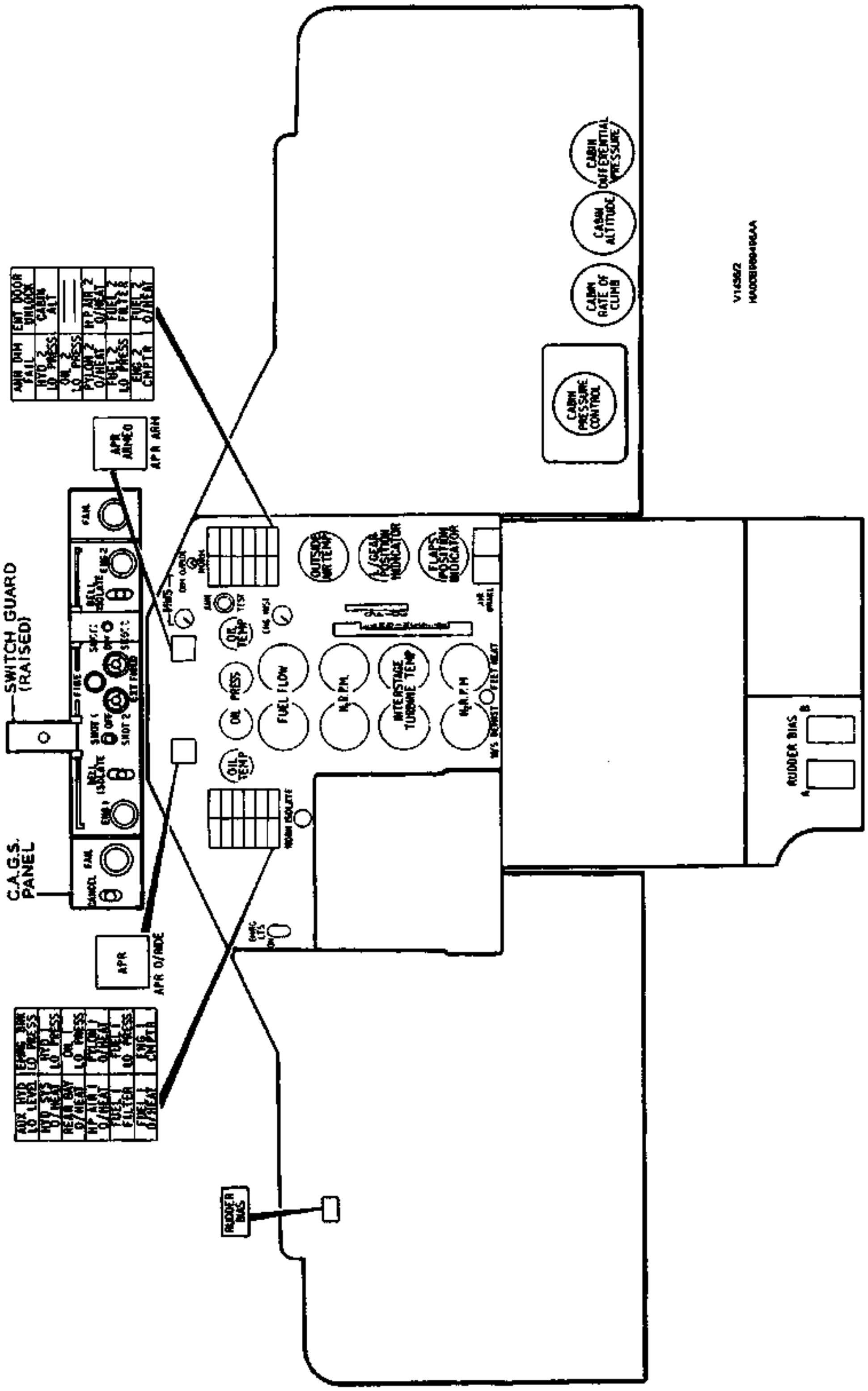
(19) Gust locks
If both engines are to be run it is necessary to unlock the aileron and elevator gust lock to obtain simultaneous full throttle on both engines (Chapter 27, GUST LOCKS).

(20) Operating limitations
Do not contravene the operating limitations. Any contravention must be recorded in the engine log book quoting the nature and degree of excess.

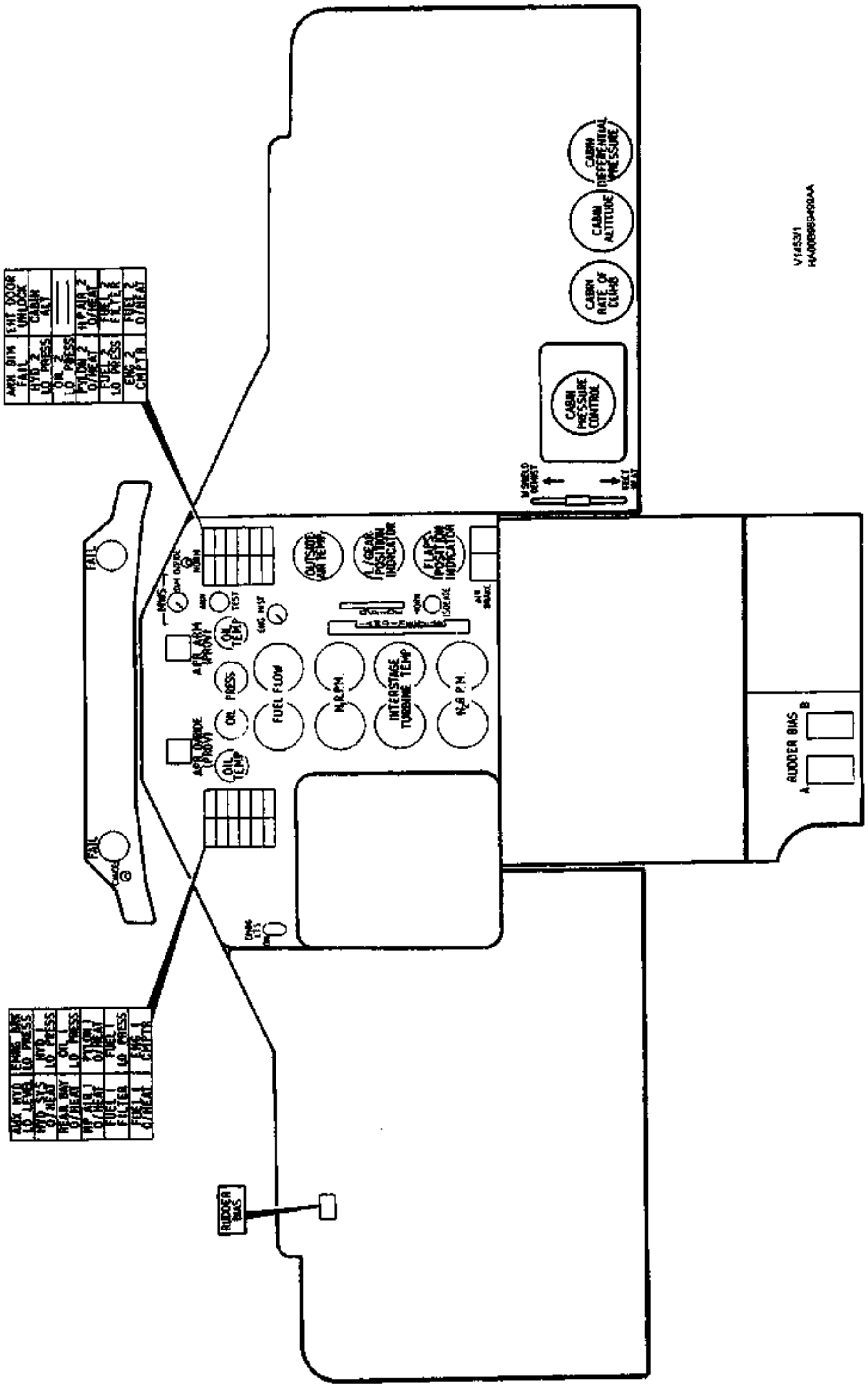
(21) Fitment of intake and exhaust covers
After engine shutdown, allow engine to cool for at least 15 minutes before installing air intake and exhaust covers.



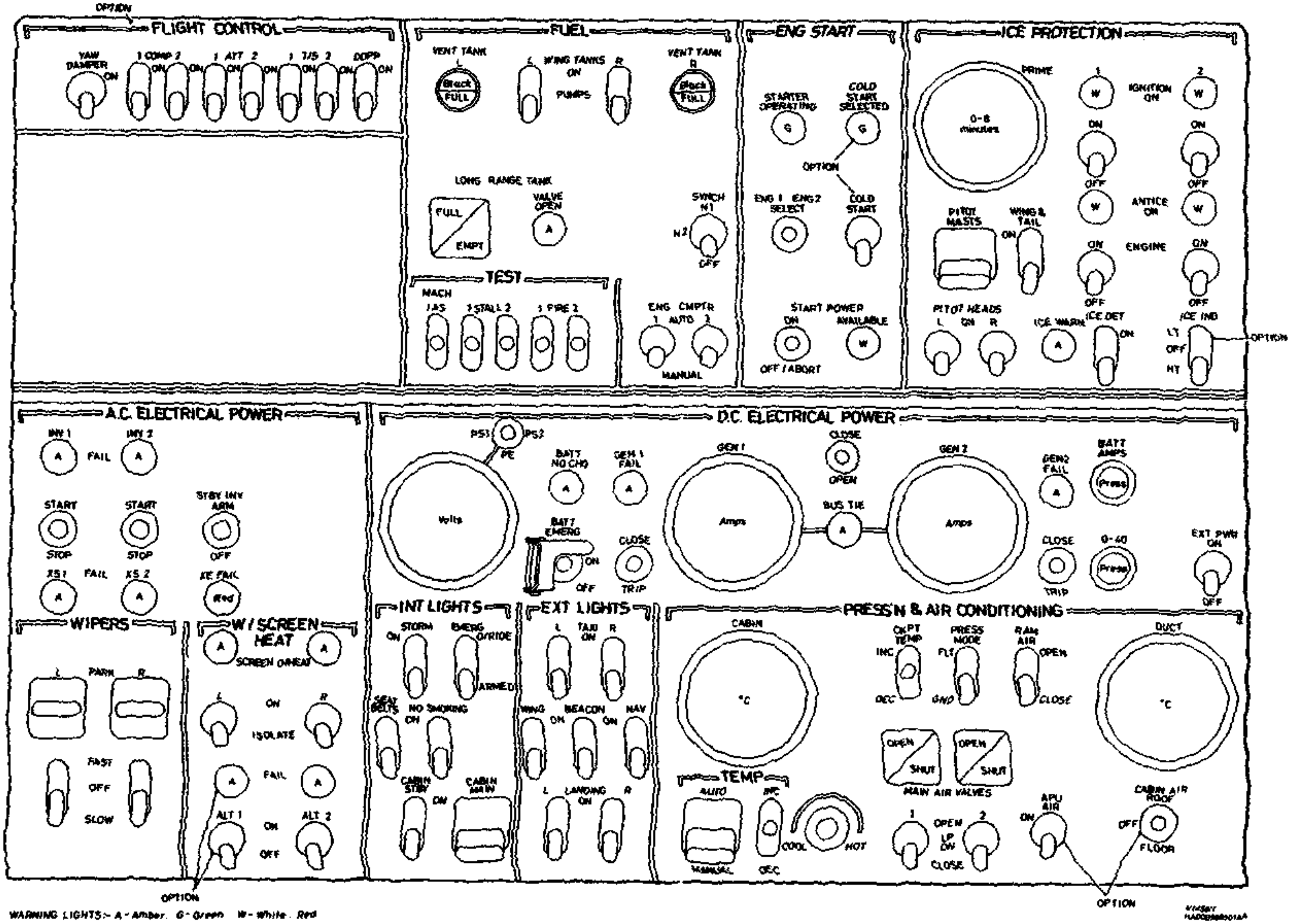
Controls and indicators -
Typical airplane flight compartment
*Figure 502*



Main instrument panel - typical
Pre A/C 25211 and NA739
*Figure 503 - Sheet 1*

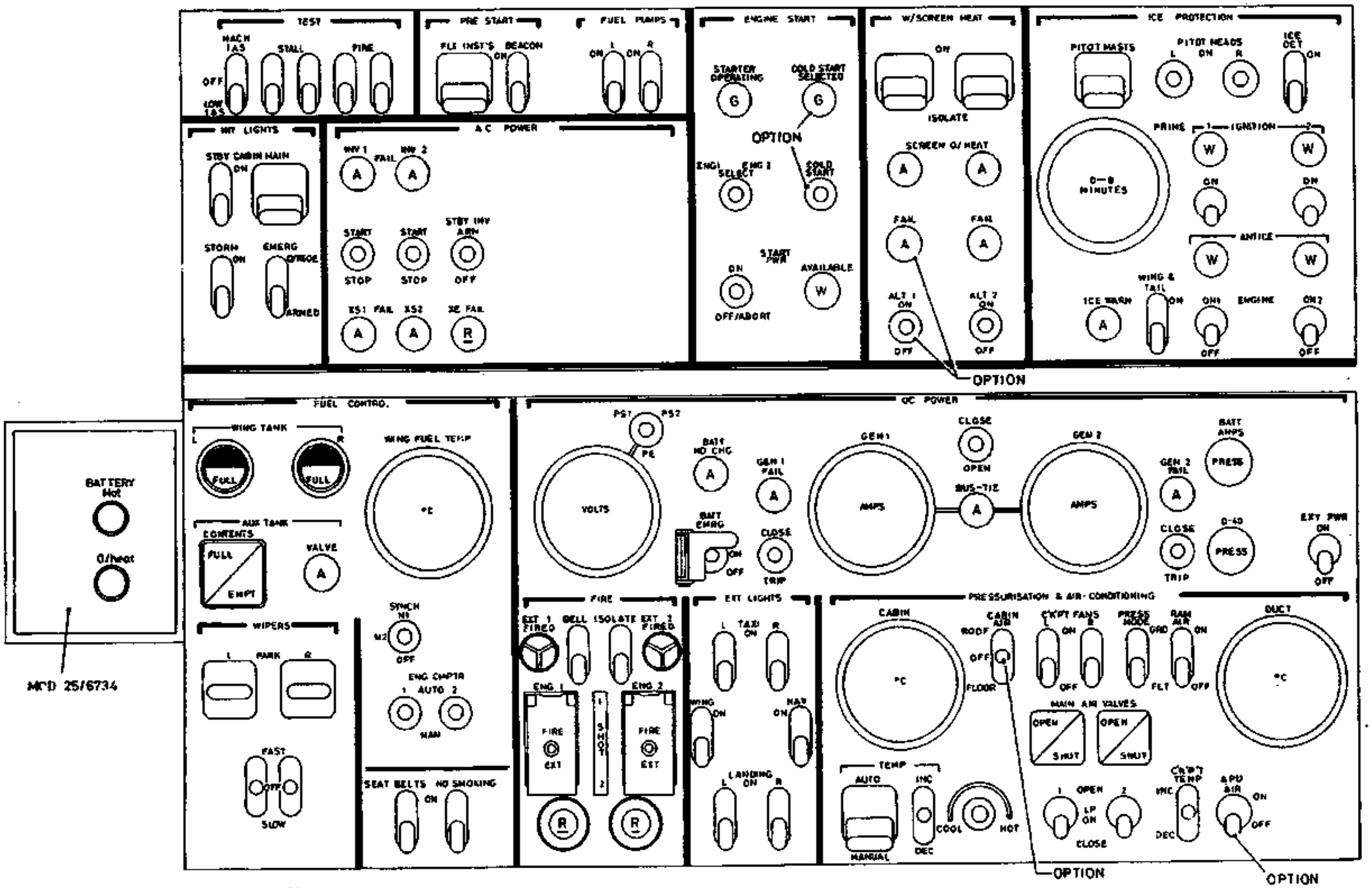


Main instrument panels - typical
A/C 25211, NA739 and subsequent
*Figure 503 - Sheet 2*



WARNING LIGHTS:- A - Amber, G - Green W - White, Red

Roof panel - typical
Pre A/C 25211 and NA739
*Figure 504 - Sheet 1*



WARNING LIGHTS

A _ AMBER
G _ GREEN
R _ RED
W _ WHITE

Roof panel - typical
A/C 25211, NA739 and subsequent
Figure 504 - Sheet 2

## 2. Ground running limitations

### A. General

*NOTE: Refer to Allied Signal Light Maintenance Manual Report No. 72-02-15, Chapter 72, ENGINE - ADJUSTMENT/TEST for all limitations other than those quoted here.*

### B. Lubrication

| | |
|---|---|
| Approved oils. | Refer to Chapter 12, SERVICING - OIL. |

### C. Fuel system

| | |
|---|---|
| Maximum fuel temp at engine inlet. | 57°C. |
| Approved fuels. | Refer to Chapter 12, SERVICING - FUEL. |
| Low pressure warning switch setting. | 6 to 7 psi. |
| Fuel filter blocked warning switch setting. | 6 to 8 psi. |
| Fuel overheat warning switch setting. | 87.8 ± 2.8°C on a rising temp; switch de-activates at 65.6°C on a falling temp. |

### D. Starter/generator duty cycle

Three successive starting cycles using airplane internal batteries or two successive starting cycles using an external power supply, each cycle of not more than 30 seconds duration with a cooling period of not less than one minute between each cycle. After the third cycle using internal batteries or the second cycle using an external power supply, if the engine has not started, there must be a cooling period of not less than 30 minutes.

*NOTE: Use only an external power supply which is installed with an 1100 amp current limiter.*

## 3. Starting, stopping and motoring

### A. Pre-starting preliminary internal check list

| | |
|---|---|
| (1) Preliminary actions prior to ground running. | Completed. |
| (2) LANDING GEAR. | |
| (a) Selector lever. | DOWN. |
| (b) O/RIDE selector. | DOWN. |
| (3) WHEEL BRAKES lever. | PARK. |

*NOTE: Make sure the BRAKES pressure is satisfactory when d.c. power is on.*

| | |
|---|---|
| (4) Windscreen Wipers left and right switches. | OFF |
| (5) Fire extinguisher selector switches. | Caged OFF. |

| | | |
|---|---|---|
| (6) | EXT FIRED fire extinguisher indicators. | Clear. |
| (7) | EXT LIGHTS switches. | All OFF, except NAV ON during hours of darkness. |
| (8) | Fuses and circuit breakers. | As required. |
| (9) | Establish electrical power supplies. | Refer to Chapter 12, ELECTRICAL POWER. |

**CAUTION: IF A GROUND POWER SUPPLY IS USED, THE EXT PWR SWITCH MUST BE OFF BEFORE CONNECTION AND THE SOCKET MUST NOT BE LIVE DURING CONNECTION.**

*NOTE: If a d.c. power supply has been established, either from a ground source or an APU (if installed) ignore paragraphs (a) to (g).*

| | | |
|---|---|---|
| (a) | GEN 1 and 2 switches. | CLOSE. Associated FAIL lights are on. |
| (b) | BUS TIE switch. | OPEN. |
| (c) | INV 1 and 2 switches. | STOP. Make sure INV 1 and INV 2 FAIL, XSI and XS2 FAIL warning are on. |
| (d) | STBY INV switch. | OFF. Make sure XE FAIL warning is on. |
| (e) | EXT PWR switch. | OFF. |
| (f) | BATT switch. | ON. CANCEL CAGS or MWS flashing FAIL lights. Make sure the START POWER AVAILABLE light stays off. |

*NOTE: If START POWER AVAILABLE light comes on, set START POWER switch to OFF/ ABORT.*

| | | |
|---|---|---|
| (g) | Read the battery volts for each battery. | 24 volt nominal. |

*NOTE: If d.c. power is not available either from a ground source or an APU (if installed), keep the use of the airplane batteries to the absolute minimum.*

(10) Flight compartment and interior lights.

| | | |
|---|---|---|
| (a) | STORM switch. | STORM if required; otherwise OFF. |
| (b) | EMERG O/RIDE-ARMED switch. | O/RIDE. |
| (c) | CABIN STBY switch. | OFF. |
| (d) | CABIN MAIN switch. | As required. |
| (e) | NO SMOKING/SEAT BELT switches. | OFF. |
| (f) | Panel and control pedestal pillar lights. | As required. |

| | | |
|---|---|---|
| (11) | ICE PROTECTION (roof panel). | All systems OFF. |

| | | |
|---|---|---|
| | (a) W/SCREEN HEAT ALT FAIL lights. | Lights are on. |
| (12) | ENGINE START (roof panel). | All systems OFF. |
| (13) | FUEL PUMPS. | |
| | (a) A/C 25211, NA 739 and subsequent:<br>Fuel PUMP L and R switches. | OFF. |
| | (b) Pre A/C 25211 and NA 739 only:<br>WING TANK PUMPS L and R switches. | OFF. |
| | (c) FUEL 1 and 2 LO PRESS annunciators. | Are on. |
| | (d) FUEL contents. | Make sure adequate. |
| (14) | PRESSN and AIR CONDITIONING (roof panel). | |
| | (a) APU AIR switch (if installed). | ON for air conditioning. |
| | (b) RAM AIR switch. | CLOSE. |
| | (c) PRESS MODE switch. | GND. |
| | (d) CKPT TEMP INC-DEC switch. | Center OFF. |
| | (e) Cabin TEMP AUTO-MANUAL switch. | MANUAL. |
| | (f) Cabin TEMP INC-DEC switch. | Center OFF. |
| | (g) Cabin TEMP COOL-HOT selector. | As required. |
| | (h) CABIN AIR switch (if installed). | As required. |
| (15) | Engine instruments. | Satisfactory. |

*NOTE: With no a.c. power on, the oil pressure readings can be disregarded.*

| | | |
|---|---|---|
| (16) | BRAKES pressure. | 1750 to 1900 psi. |
| (17) | Master Warn System TEST push switch. | Depress and hold switch; Make sure all the annunciators come on. Release push button. CANCEL flashing FAIL lights. |
| (18) | PULL EMERG U/C handle and indicator rod. | Make sure in. |
| (19) | DUMP VALVE selector lever. | SHUT. |
| (20) | AIR BRAKE selector lever. | SHUT. |

*NOTE: AIR BRAKE position indicators will probably display OPEN until hydraulic pressure is normal.*

| | | |
|---|---|---|
| (21) | FLAPS selector. | Corresponds with flap position. |

| | |
|---|---|
| (22) Radio and navigation system. | All off. |
| (23) Safety equipment: | |
| (a) Hand torch. | Stowed. |
| (b) Portable fire extinguisher. | Stowed. |
| (c) Axe. | Stowed. |

*NOTE: These are behind the Pilot's seat.*

| | |
|---|---|
| (24) Flight compartment windows. | As required. |
| (25) EMERGENCY EXIT, passengers. | Closed and locked. |
| (26) BATT switch. | As required. |

*NOTE: If airplane batteries are the only source of d.c. power, select BATT switch OFF.*

| | |
|---|---|
| (27) Electrical services switches (adjacent to entrance door). | |
| (a) All domestic services heaters. | OFF. |

**CAUTION: DO NOT LEAVE DOOR OR WINDOWS OPEN IN INCLEMENT WEATHER.**

| | |
|---|---|
| (28) Flight compartment entrance door. | As required. |

### B. Pre-starting external check list

*NOTE: An electric hand torch will be required when completing checks in the rear equipment bay.*

| | |
|---|---|
| (1) Pre-starting preliminary internal check list. | Completed. |
| (2) Nose gear bay: | |
| (a) Gear lock pin. | Installed. |
| (b) Hydraulic leaks. | Make sure no leaks. |
| (3) Fuselage nose - left side: | |
| (a) Radome. | Closed, fasteners locked. |
| (b) Ice detector, pitot head and OAT probe. | Covers removed, undamaged. |
| (c) Static vent plates. | Plugs removed, vents unobstructed. |

(4) Fuselage nose - right side:

| | |
|---|---|
| (a) Radome fasteners. | Locked. |
| (b) NACA intake (on top of nose). | Unobstructed. |
| (c) Pitot head. | Cover removed, undamaged. |
| (d) Static vent plates. | Plugs removed, vents unobstructed. |

(5) Fuselage - right side:

| | |
|---|---|
| (a) EMERGENCY EXIT. | Locked. |
| (b) De-icing tank. | Tank cap and cover secure. |

(6) Right wing:

| | |
|---|---|
| (a) Wing/fuselage fillet panels. | Secure. |

*NOTE: While in front of airplane do a check of the engine and heat exchanger intakes from here (paragraphs 7.(a) and 8.(a)).*

| | |
|---|---|
| (b) Top skin access panels. | Secure. |
| (c) Tank filler cap. | Secure. |
| (d) Bottom skin access panels including center section. | Secure. |
| (e) Water drain valves (2). | Intact. |
| (f) Fuel leaks. | Make sure no leaks. |
| (g) Stall warning vent plug. | Removed. |
| (h) Vent surge tank intake. | Unobstructed. |
| (i) Right main gear. | Lock pin installed, no fluid leaks, chock in position. |

(7) Right engine:

| | |
|---|---|
| (a) Air intake. | Cover removed, free from foreign bodies. |
| (b) Inlet sensor. | Clean, undamaged and secure. |
| (c) $N_1$ rotor. | Free to rotate, blades undamaged. |
| (d) Exhaust. | Cover removed, free from foreign bodies, turbine undamaged. |
| (e) Atmospheric vents and exhausts. | Unobstructed and undamaged. |
| (f) Engine oil system level. | 3.6 US pts (3 Imp pts, 1.7 liters) low, minimum. |

| | |
|---|---|
| (g) Servicing access panels. | Secure. |
| (h) Fuel and oil leaks. | Make sure no leaks. |
| (i) Fuel and oil drains. | Clear, no drainage. |
| (j) Cowlings. | Closed and locked or open and secured as required. |
| (k) Fillet access panels. | Secure. |
| (8) Rear fuselage: | |
| (a) Heat-exchanger exhaust. | Unobstructed. |
| (b) Ventral fuel tank (if installed). | Pressure refuel access - refuel point cap and panel secure. No leaks. |
| (c) Ground power socket. | Power connected or panel secure. |
| (d) Tail cone fairing. | Cover removed, fasteners locked. |
| (e) APU air inlet and exhaust doors. | Open if APU is running, otherwise closed. |
| (f) Panels, fairings and aerials. | Secure and undamaged. |
| (g) Heat exchanger air intake. | Undamaged and unobstructed. |
| (h) Left side of fuselage: Fire bottle pressure relief discharge indicators. | Discs intact. |
| (9) Rear equipment bay: | |
| (a) Hydraulic accumulators. | Make sure the pressure is at least 1750 psi. |
| (b) Hydraulic reservoir. | Make sure the minimum contents are appropriate to pressure, cap secure. No leaks. |
| (c) All loose extraneous equipment. | Removed. |
| (d) Bay door. | Closed. |
| (10) Left engine. | Do the checks as per paragraph (7). |
| (11) Left wing. | Do the checks as per paragraph (6). |

### C. Engine starting check list

*NOTE: Use an external ground power supply if available, otherwise make sure that the condition of the airplane batteries is such as will permit a start on internal power.*

*NOTE: Operations identified thus * are repeated when starting the second engine.*

| | |
|---|---|
| (1) Pre-starting external check list. | Completed. |

| | |
|---|---|
| (2) Fuses and circuit breakers. | As required. |

**CAUTION: IF A GROUND POWER SUPPLY IS USED, THE EXT PWR SWITCH MUST BE OFF AND THE SOCKET MUST NOT BE LIVE DURING CONNECTION.**

| | |
|---|---|
| (3) Establish electrical power supplies. | Refer to Chapter 12, ELECTRICAL POWER. |

*NOTE: If an external power supply is already established, or the APU is used, ignore paragraphs (a) to (c).*

| | |
|---|---|
| (a) BATT switch. | ON. Cancel flashing FAIL lights. |
| (b) EXT PWR switch. | ON if power available. |
| (c) External start - INV 1 and/or 2 switch. | START, if power available. Make sure the INV 1 and/or 2 and XS1 and XS2 FAIL warnings stay OFF. |
| (4) BEACON switch. | ON during the hours of darkness, otherwise OFF. |
| (5) Engine oil temperature(s). | Within limits. |
| (6) Test ignition system(s): | |
| (a) MAke sure clear with ground crew for test. | Clear. |
| (b) IGNITION 1 or 2 switch(es). | Select ON, aurally make sure the igniters operate and the IGNITION light(s) come(s) on. Select OFF. |

*NOTE: External crew member to make sure each engine to be run is servicible.*

| | |
|---|---|
| (7) ENGINE antice. | OFF. |
| (8) Fuel control levers - center pedestal: | |
| (a) X-FEED/TRANSFER lever. | As required. |
| (b) FUEL TRANSFER magnetic indicator (RH instrument panel). | OPEN when lever is down (TRANSFER) or SHUT at any other lever position. |
| (c) LONG RANGE TANK COCK lever (If installed). | Up position. |
| (d) LONG RANGE TANK VALVE OPEN light or (A/C 25211, NA739 and subsequent) AUX TANK VALVE OPEN light. | Light OFF. |
| (e) LP cock(s). | ON. |
| (f) HP cock(s). | ON. |

| | | |
|---|---|---|
| (9) | Throttle lever(s). | Do a check for full travel and then set closed. |
| (10) | HP cock(s). | OFF (down and gated). |
| (11) | TEST (roof and CAGS panels) and central pedestal: | |
| | (a) FIRE 1 and/or 2 switches. | Do a check of the bell, HP cock light(s), ENG 1 and/or 2 FIRE warning light, MWS system FAIL lights flashing. |
| | (b) Cancel warn system flashing FAIL lights. | |
| (12) | AIR VALVES 1 and 2 switches. | CLOSE, indicators display shut. |
| (13) | * FUEL. | |
| | (a) ENG CMPTR 1 and/or 2 switch(es). | AUTO for normal start mode, MANUAL for manual start mode. |
| | (b) ENG 1 and/or 2 CMPTR annunciator(s). | OFF with AUTO selected or ON with MANUAL selected. |
| | (c) Engine SYNC switch. | OFF. |
| | (d) A/C 25211, NA739 and subsequent:<br>FUEL PUMPS L or R switch(es). | ON. |
| | (e) Pre A/C 25211, NA739 only:<br>WING TANK PUMPS L or R switch(es). | ON. |
| | (f) External power start - First engine only<br>or<br>Internal power start - Second engine | FUEL 1 or 2 LO PRESS annunciator stays OFF. |
| (14) | * Make sure clear with ground for starting | Clear. |

*NOTE: If starting both engines start No.2 engine first*

| | | |
|---|---|---|
| (15) | * START POWER switch | ON. Make sure START POWER AVAILABLE light comes ON. |
| (16) | Internal start - First engine only | |
| | (a) STBY INV | ARM. Make sure XE FAIL warning light goes OFF. |
| | (b) As necessary - COLD START switch | PRESS. Make sure COLD START SELECTED light comes ON. |

*NOTE: Selection of COLD START puts the airplane batteries in series.*

| | | |
|---|---|---|
| (17) | * ENG 1 or 2 SELECT switch. | ENG 1 or 2. Press and release when STARTER OPERATING LIGHT comes on. Make sure $N_2$ rpm increases. |
| (18) | * HP COCK 1 or 2 lever. | Select ON when: |
| | (a) Computer AUTO mode. | $N_2$ rpm 10%. |
| | (b) Computer MANUAL mode. | $N_2$ rpm 15%. |
| (19) | * IGNITION 1 or 2 light. | Light comes ON. |
| (20) | * As necessary - FUEL ENRICH 1 or 2 button. | Depress intermittently until ITT reaches 400°C. |

*NOTE: Fuel enrichment is inoperative with computer in MANUAL mode.*

| | | |
|---|---|---|
| (21) | * Fuel flow. | Make sure fuel starts to flow. |
| (22) | * ITT. | Make sure light-up is within 10 sec of opening the HP cock. |
| (23) | * Engine speed. | Make sure $N_2$ rpm for a smooth, rapid acceleration to 24%. Make sure $N_1$ rpm is increasing. |

**CAUTION: CLOSE HP COCK AND SELECT START POWER SWITCH TO ABORT/OFF IF:**

**NO LIGHT-UP WITHIN 10 SEC OF OPENING HP COCK**
**OR, ITT RAPIDLY APPROACHES 907°C**
**OR, NO INDICATION OF $N_1$ RPM BEFORE 20% $N_2$ RPM**
**OR, $N_1$ OR $N_2$ RPM STOP INCREASING BEFORE REACHING IDLE SPEED**
**OR, ENGINE NOT AT IDLING SPEED WITHIN 50 SEC OF LIGHT-UP**
**OR, NO INDICATION OF OIL PRESSURE AT IDLE SPEED**
**OR, OIL PRESSURE OUTSIDE IDLE OR COLD WEATHER TRANSIENT LIMITS**

*NOTE: At engine start initiation, both $N_1$ indicators may give spurious indications. These will clear as $N_2$ increases, and true $N_1$ indication will be available before 20% $N_2$.*

| | | |
|---|---|---|
| (24) | * OIL pressure indictors - external power only. | If no indication within 10 sec. of light-up, close HP cock. |
| (25) | * STARTER OPERATING light. | Light goes OFF at approx. 50% $N_2$ rpm. |
| (26) | As necessary - COLD START switch. | RELEASE. Make sure COLD START SELECTED light goes OFF. |
| (27) | * IGN 1 or 2 light. | Go OFF at approx 50% $N_2$ rpm. |

| | |
|---|---|
| (28) * Engine idling speed. | Make sure obtained within 50 sec. of light-up: |
| (a) $N_1$ rpm. | Stabilized at approx 30%. |
| (b) $N_2$ rpm. | Stabilized at 48% to 67%. |
| (29) * OIL 1 or 2 LO PRESS annunciator. | Make sure stays OFF. |
| (30) * If icing conditions prevail. | Select ENG ANTICE 1 or 2 ON. Make sure indication are satisfactory. |
| (31) * With engine(s) idling, make sure that: | |
| (a) OIL pressure. | 25 to 46 psi. |

*NOTE: If starting with extremely low oil temperature, transient oil pressure of 55 psi is permissible for not more than 3 minutes.*

| | |
|---|---|
| (b) ITT. | Satisfactory. |
| (c) Fuel flow. | Satisfactory. |
| (d) COLD START only - battery volts. | Not more than 28 volts. |
| (e) HYD 1 or 2 LO PRESS annunciator. | Light OFF. |
| (f) EMER BRK LO PRESS annunciator. | Light OFF. |
| (g) HYD pressure. | 3000 psi. |
| (h) Hydraulic system. | Do a functional check. |
| (i) APR (if fitted). | O/RIDE and ARM lights OFF. |
| (32) To start second engine. | Repeat paragraphs (13) to (15) inclusive, (17) to (25) inclusive and (27) to (31) inclusive. |

*NOTE: These paragraphs are identified by an *.*

| | |
|---|---|
| (33) START POWER switch. | OFF/ABORT. |

**WARNING: KEEP CLEAR OF EXHAUST EFFLUX.**

**CAUTION: THE EXT PWR SWITCH MUST BE OFF AND THE SOCKET MUST NOT BE LIVE DURING DISCONNECTION.**

| | |
|---|---|
| (34) External power start only -<br>Disconnect ground power supply: | |
| (a) EXT PWR switch. | OFF. |
| (b) Ground power socket. | Disconnect. |

| | |
|---|---|
| (35) Make sure d.c. generation is satisfactory: | |
| (a) GEN 1 and/or 2 FAIL light(s). | Lights OFF. |
| (b) BATT NO CHG light. | Light OFF. |
| (c) BUS TIE switch. | OPEN. BUS TIE light ON |
| (d) Voltage selector switch. | Select PS1, PE and PS2 in turn:<br>make sure each busbar reads 28 ± 0.75 volts. |
| (e) BATT AMPS push switch(es). | Press upper switch and read amperage.<br>If reading is below 40 amps., press 0-40 AMPS switch and again read amperage. |
| (f) BUS TIE switch | CLOSE, BUS TIE light goes OFF. |
| (36) Make sure a.c. generation is satisfactory: | |
| (a) INV 1 and 2 switches. | START. Make sure INV 1, INV 2, XS1 and XS2 FAIL indicators go OFF |
| (b) STBY INV switch. | ARM. Make sure STBY INV FAIL indicator goes OFF. |
| (37) W/SCREEN HEAT ALT switch(es). | Hold ON. Make sure FAIL warning goes OFF, then switch OFF. |
| (38) Master Warn System annunciators. | All OFF, with all systems *operative* |

*NOTE: The Master warning system will indicate a failure if:*
*Both or one engine is static.*
*The d.c. and/or a.c. generators are not functioning.*
*The inverters are not switched on.*
*A defect exists in any of the engine or airplane systems being monitored (Refer to Chapter 31, MASTER WARNING SYSTEM).*

### D. Engine stopping check list

*NOTE: If both engines are running stop the first engine to be started and function test the hydraulic pump of the other engine which is still running.*

| | |
|---|---|
| (1) FLAPS. | UP. |
| (2) AIRBRAKES. | SHUT. |
| (3) Throttle(s). | Idle rpm for 3 min. |
| (4) Radio and accessory electrical systems. | All off. |
| (5) ICE PROTECTION (roof panel). | All systems off. |
| (6) PRESSN and AIR COND. | All systems off unless APU is running. |

| | | |
|---|---|---|
| (7) | APR (if installed). | O/RIDE and ARM lights OFF. |
| (8) | HP cock(s). | OFF. |
| (9) | Record roll down time(s). | Compare with established figures. |
| (10) | ENG CMPTR 1 and/or 2 switch(es). | MANUAL. Make sure annunciator(s) ON. |
| (11) | Fuel | |
| | (a) Pre A/C 25211 and NA 739 only: WING TANK L and/or R PUMP switch(es). | OFF when engine(s) are stationary. |
| | (b) A/C 25211, NA 739 and subsequent: FUEL PUMPS L and/or R switch(es). | OFF when engine(s) are stationary. |
| (12) | LP cock(s), engine(s) stationary. | As required. |

*NOTE: Do not close No.1 engine LP cock if APU is running.*

| | | |
|---|---|---|
| (13) | GEN 1 and/or 2 FAIL light(s). | Make sure lights ON as engine(s) run down. |

*NOTE: If the GEN FAIL light(s) are not on, the engine(s) starter/generator may remain energized, therefore, set the BATT EMERG-ON-OFF switch to OFF; make sure BUSTIE is OPEN.*

*NOTE: If an APU is installed and running, shut down the APU.*

*NOTE: Subsequent to satisfactory shut down of engine, complete the remainder of the shut down drill.*

*NOTE: Before completing paragraphs (15) and (16) and, before further application of electrical power to the airplane, the cause of the malfunction must be established and rectified.*

| | | |
|---|---|---|
| (14) | EXT LIGHTS. | OFF. |
| (15) | Fuses and circuit breakers. | As required. |
| (16) | ELECTRICAL POWER supplies. | As required. |

*NOTE: If the airplane battery is the only source of d.c. power, select battery switch OFF.*

| | | |
|---|---|---|
| (17) | Engine and airplane covers. | Install as necessary. |

*NOTE: Allow engine to cool for at least 15 minutes before installing covers.*

| | | |
|---|---|---|
| (18) | Landing gear wheels. | Make sure chocked. |
| (19) | WHEEL BRAKE lever. | NORM. |
| (20) | Flight compartment windows and all access doors. | As required |

*NOTE: If the airplane is to be towed, disconnect the steering pin prior to towing.*

### E. Engine motoring check list

*NOTE: Each motoring cycle should not exceed 30 seconds; do not exceed starter limitations.*

| | |
|---|---|
| (1) Landing gear lock pins. | Installed. |
| (2) Engine and airframe covers. | Remove as necessary. |
| (3) Engine air intake and exhaust. | Clear of foreign bodies. |
| (4) Power plant atmospheric vents and exhausts. | Unobstructed. |
| (5) Engine oil system level | 3.6 US pts (3 Imp pts, 1.7 liters) low, minimum. |
| (6) Cowlings. | Closed and locked or open and secured. |
| (7) Fuses and circuit breakers: | |
| (a) High energy ignition. | Remove fuses. |

*NOTE: Alternatively, if the engine upper panel is off, remove the LT input lead to each HE unit.*

| | |
|---|---|
| (8) Radio and accessory electrical systems. | All OFF. |
| (9) Establish electrical power supplies. | Refer to Chapter 12, ELECTRICAL POWER. |

**CAUTION: WHEN CONNECTING GROUND POWER THE EXT PWR SWITCH MUST BE OFF AND THE SOCKET MUST NOT BE LIVE DURING CONNECTION OR DISCONNECTION.**

*NOTE: Do not motor on internal batteries during routine maintenance*

| | |
|---|---|
| (10) ELECTRICAL POWER (roof panel): | |
| (a) A.C. power. | All OFF. |
| (b) BATTERY switch. | ON. |
| (c) EXT POWER switch. | ON. |
| (d) VOLTS PS1, PE, PS2 busbar. | 28 volt nominal. |
| (e) INV 1 or 2 switch(es). | START. Make sure the FAIL warning lights are OFF. |
| (11) Control levers - centre pedestal: | |
| (a) LONG RANGE TANK cock lever. | Up position. |
| (b) FUEL X-FEED/TRANSFER lever. | As required. |
| (c) LP cock(s). | ON. |
| (d) HP cock(s). | ON, if required. |

| | | |
|---|---|---|
| | (e) Throttle(s). | Closed. |
| (12) | ENG CMPTR 1 or 2 switch. | MANUAL. |
| (13) | FUEL PUMPS: | |
| | (a) Pre A/C 25211 and NA739 only:<br>WING TANK L and/or R PUMPS switches. | OFF when engine(s) stationary. |
| | (b) A/C 25211, NA739 and subsequent:<br>FUEL PUMPS L and/or R switches. | OFF when engine(s) stationary. |
| (14) | Make sure clear with ground crew for motoring. | Clear. |
| (15) | START POWER switch. | ON. Make sure START POWER AVAILABLE light comes ON. |
| (16) | ENG 1 or ENG 2 SELECT switch | Press and release when STARTER OPERATING light comes ON. |
| (17) | IGNITION 1 or 2 light(s). | ON. |
| | *NOTE: Observe rising oil pressure as engine rotates.* | |
| (18) | START POWER switch. | OFF/ABORT to terminate motoring cycle. |
| (19) | STARTER OPERATING, START POWER AVAILABLE, IGNITION 1 or 2 | Lights OFF. |
| (20) | With cycle completed and engine stationary: | |
| | (a) HP cock(s). | OFF. |
| | (b) LP cock(s) | As required. |
| | *NOTE: If an APU is installed and running, do not close No.1 engine LP cock.* | |
| | (c) FUEL PUMP switch(es). | All OFF. |
| (21) | Fuses and circuit breakers. | Install HE ignition fuses. |
| | *NOTE: If HE unit LT input cables were disconnected reconnect them before installing fuses.* | |
| (22) | ELECTRICAL POWER supplies. | As required. |
| (23) | Engine and airplane covers. | As required. |

## 4. Ground running adjustments and tests

NOTE: *Maintain record of test running. After changing or servicing specific units selected portions of the Low and High Power Tests may be used (as detailed in the respective maintenance practices) to test the relevant parts of the installation.*

NOTE: *During low power test it is desirable to have more than one observer to monitor and record the various starting times, temperatures and speeds.*

NOTE: *Initial high power testing should be done with all interfaces to the engine connected. If the specified parameters are not achieved, then leakage from the airplane bleed air systems should be considered a possibility. To make sure , repeat the test with all LP and HP bleed ports capped at the engine to isolate the airplane bleed-air systems from the engine. If this results in satisfactory parameters, further investigate the airplane bleed air systems (Refer to Chapter 21, AIR CONDITIONING). On re-connection of engines to the airplane bleed-air systems, make sure that a leak check is done on all disturbed bleed-air ducts and/or pipes.*

### A. Low power test

| | ITEM | CONDITION | NOTES |
|---|---|---|---|
| (1) | Fuel type. | Before start. | Record computer setting and fuel type. |
| (2) | Fuel temperature. | Before start. | |
| (3) | OAT. | Before start. | |
| (4) | Ambient pressure altitude. | Before start. | Feet. |
| (5) | Airplane batteries. | Before start. | 24 volts min. |
| (6) | The d.c. ground supply. | Before start. | 26 volts min. for external start. |
| (7) | Oil temperature. | Before start. | -40°C min. without preheating. 127°C max. |
| (8) | Starting time. | 'Starter operating' light on. | Record. |
| (9) | Time to light-up. | | Record, record abortive starts. |
| (10) | ITT. | During start. | 927°C max. Record. |
| (11) | Starting cycle: | | |
| | (a) Time from 10% $N_2$, to light-up. | | 10 secs. max. Record. |
| | (b) 'Starter operating' light out. | | Approx. 50% $N_2$. Record. |
| | (c) Time from light-up to idle. | | 50 secs. max. Record. |

| | | |
|---|---|---|
| (12) Engine speed | Idling. | Up to 15°C and 2000ft. |
| (a) $N_1$ | | 30% approx. |
| (b) $N_2$ | | 48% to 67%. |
| (13) Oil pressure. | Idling. | 25 to 46 psi. Record. OIL LO PRESS annunciator goes OFF above 25 psi. |
| (14) ITT. | Idling. | Record. |
| (15) Fuel pressure. | Idling. | ENG LO PRESS annunciator goes out. |
| (16) Fuel flow. | Idling. | Make sure reading is satisfactory. |
| (17) Fuel, oil and gas leaks. | Idling. | Run for 2 minutes and do a check for leaks, (Refer to Chapter 71, DRAINS). |
| (18) D.C. power generation. | Idling. | Refer to Chapter 24, GENERAL. |
| (a) Failure warning. | | GEN FAIL annunciator OFF. |
| (b) Voltage. | | 28 ± 1.0 volts. |
| (c) Ammeter. | | Showing charge. |
| (d) Load sharing. | Both engines running. | With 10% amps of mean. |
| (19) A.C. power generation. | Idling. | Refer to Chapter 24 (Windshield heating). |
| (a) Power failure indication. | | ALTR FAIL annunciator(s) OFF. |
| (20) Hydraulic system. | Idling. | 3000 psi. |
| (a) Pressure. | | HYD LO PRESS annunciator(s) OFF. |
| (b) System functioning. | | Do a check of the flap operation. |

*NOTE: If High Power Test is to follow, make sure there are no fuel or oil leaks and ignore remainder of this test.*

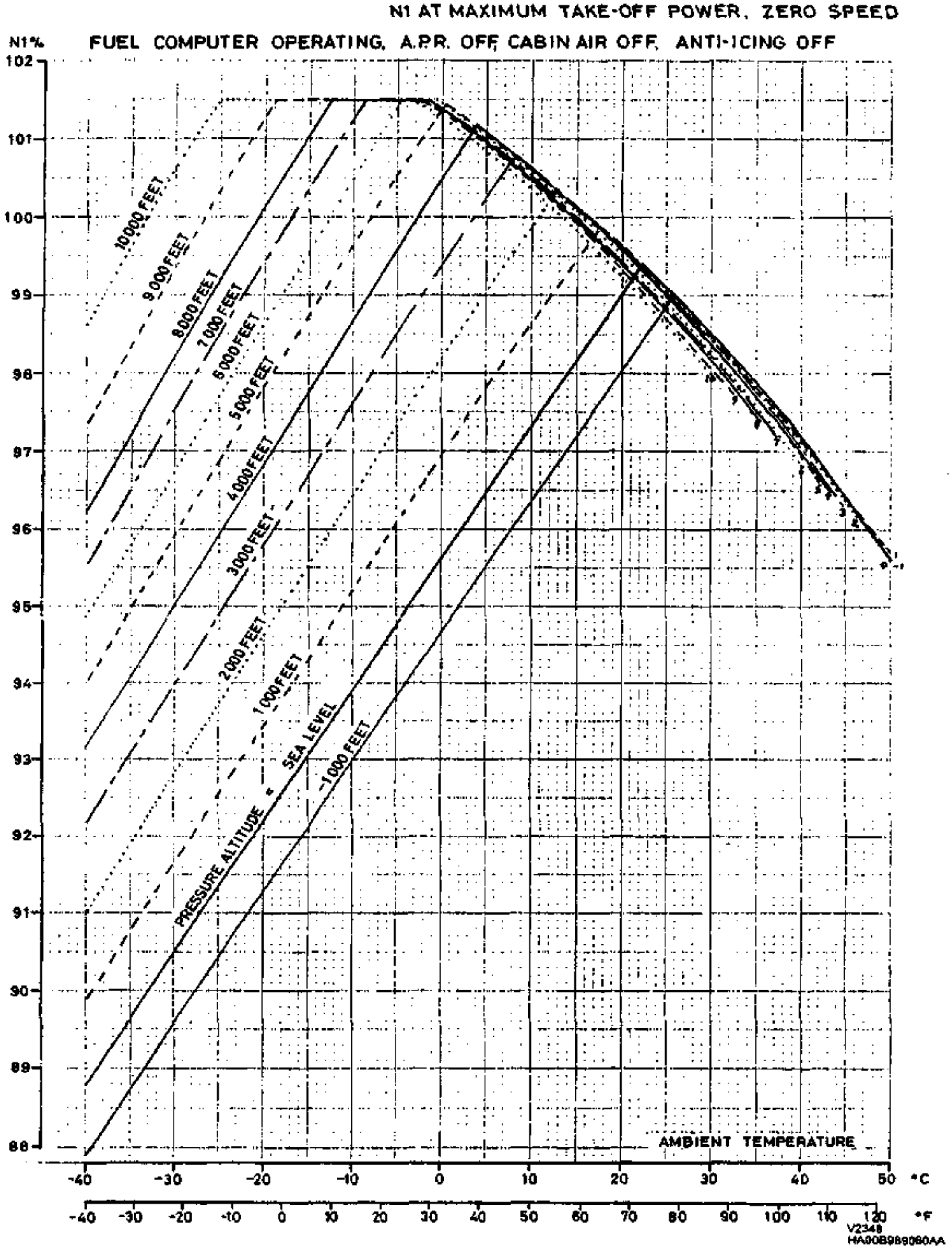
| | | |
|---|---|---|
| (21) Time. | On closing HP fuel cock. | Record. |
| (22) Roll down times. | | Record and/or compare with established figures. |
| (23) Drains. | During roll down | Make sure satisfactory. |
| (24) Fuel and oil leaks. | Engine static. | Make sure no leaks exist. |
| (25) Total running time for this test. | | Record. |

### B. High power test

| | ITEM | CONDITION | NOTES |
|---|---|---|---|
| (1) | Ascertain $N_1$ ref. speed for O.A.T. and pressure altitude. | Air conditioning off. | Refer to *Figure 505.* |
| (2) | Complete paragraphs 4.A. (1) to (20) of low power test. | | |
| (3) | Parking brake pressure. | | Make sure adequate. |
| (4) | Oil temperature. | Idling. | Above 30°C. |
| (5) | New or overhauled engine only - Post installation test | | Test engine as detailed in Allied Signal Light *Maintenance Manual* Report No. 72-02-15, Chapter 72, ENGINE- ADJUSTMENT/TEST. |
| (6) | Engines other than new overhauled - Post re-installation test. | Full throttle. | Make sure $N_1$ speed satisfactory after 3 or minutes. |

**WARNING: DO NOT DEPRESSURIZE RAPIDLY UNLESS ABSOLUTELY ESSENTIAL.**

| | ITEM | CONDITION | NOTES |
|---|---|---|---|
| (7) | Air bleeds (if disturbed). | 40% $N_1$ speed. | Do a check of the re-connected ducts for leaks. |
| | (a) Air conditioning and pressurization system. | No other bleeds. | Refer to Chapter 21.<br>MAIN AIR VALVE annunciator is ON. Make sure ITT rises approx 40°C. |
| | (b) Engine anticing. | No other bleeds. | Refer to Test C (Test engine anti-icing system). ENG 1 or 2 ANTICE and ENG ICE PROT annunciators are ON. Make sure ITT rises approx 10-15°C. |
| (8) | Synchronization. | Both engines running. | Refer to Test D (Test engine synchronizer). |
| (9) | Throttle alignment. | Both engines 75% $N_1$ | No stagger (Refer to Chapter 76, ENGINE CONTROLS). |



Take-off power setting graph
*Figure 505*

| | | | |
|---|---|---|---|
| (10) | Select idle speed. | | Idle engine for 3 mins. |
| (11) | Close HP cock. | | Record time. |
| (12) | Roll down time. | | Record $N_1$ and $N_2$ times; compare with established figure. |
| (13) | Drains. | During roll down. | Make sure satisfactory. |
| (14) | Fuel and oil leaks. | Engine static. | Make sure none exist. |
| (15) | Total running time for this test. | | Record. |

### C. Test engine anti-icing system

**CAUTION: AT OAT ABOVE 5°C DO NOT EXCEED 10 SECONDS WITH ANTICE ON.**

(1) Run the engine at 40% $N_1$ speed; note ITT.

(2) Select ENG ANTICE 1 and/or 2 switch(es) ON.

(3) Make sure ENG 1 and/or 2 and ENG ICE PROT ON annunciators come on.

*NOTE: The ITT will increase by approximately 10-15°C.*

(4) Select ENG ANTICE 1 and/or 2 switch(es) to OFF.

(5) Make sure that related annunciator lights go out within 10 seconds and ITT decreases.

(6) Close throttles.

### D. Test engine synchronizer

*NOTE: The nominal max. authority of the synchronizer is 2.5% $N_2$ rpm on selection of either $N_1$ or $N_2$. Engine No.1 (left hand) is the master.*

(1) Run both engines at idle speed for three minutes to allow them to stabilize.

(2) Make sure the ENG SYNC is selected OFF.

(3) Run engine No.1 at 85% $N_2$ rpm and engine No.2 at 80% $N_2$.

(4) Record $N_1$ and $N_2$ speeds of both engines.

(5) Select ENG SYNC to $N_1$.

(6) Observe $N_2$ speed of engine No.2; it should increase 2.5 - 3.0% rpm.

(7) Select ENG SYNC to OFF.

(8) Observe $N_1$ and $N_2$ speeds of both engines; they should revert to those in paragraph (4).

(9) Select ENG SYNC to $N_2$.

(10) Observe $N_2$ speed of engine No.2; it should increase 2.5 - 3.0% rpm.

(11) Select ENG SYNC to OFF.

(12) Observe $N_1$ and $N_2$ speeds of both engines they should revert to those in paragraph (4).

(13) Increase speed of engine No.2 to 90% $N_2$ rpm; retain engine No.1 at 85% $N_2$ rpm.

(14) Record $N_1$ and $N_2$ speeds of both engines.

(15) Select ENG SYNC to $N_1$.

(16) Observe $N_2$ speed of engine No.2; it should decrease 2.5 - 3.0% rpm.

(17) Select ENG SYNC to OFF.

(18) Observe $N_1$ and $N_2$ speeds of both engines; they should revert to those in paragraph (14).

(19) Select ENG SYNC to $N_2$.

(20) Observe $N_2$ speed of engine No.2; it decrease 2.5 -3.0% rpm.

(21) Select ENG SYNC to OFF.

(22) Observe $N_1$ and $N_2$ speeds of both engines; they should revert to those in paragraph (14).

(23) Fully close throttle of engine No.1 and fully open throttle of engine No.2.

(24) Select ENG SYNC to $N_1$.

(25) Accelerate engine No.1 to full throttle and then back to idle speed; there should be no response from engine No.2.

*NOTE: Monitor ITT for signs of response.*

(26) Select ENG SYNC to $N_2$.

(27) Accelerate engine No.1 to full throttle and back to idle speed; there should be no response from engine No.2.

*NOTE: Monitor ITT for signs of response.*

(28) Select ENG SYNC to OFF.

(29) Fully close throttle of engine No.2 and fully open throttle of engine No.1.

(30) Select ENG SYNC to $N_1$.

(31) Accelerate engine No.2 to full throttle and then back to idle speed, there should be no response from engine No.1.

*NOTE: Monitor ITT for signs of response.*

(32) Select ENG SYNC to $N_2$.

(33) Accelerate engine No.2 to full throttle and then back to idle speed; there should be no response from engine No.1.

*NOTE: Monitor ITT for signs of response.*

(34) Fully close throttle at engine No.2.

**E. Test automatic performance reserve system**

(1) Record reading of APR EVENT counter (Pre-Mod.252719).

(2) Start both engines and run at idle speed, making sure No.1 and No.2 engine fuel computers are in AUTO.

(3) Make sure the system is disarmed and both annunciators are OFF.

(4) ARM the system and make sure APR ARMED white annunciator only comes ON.

(5) Open either throttle until at approx 5% $N_2$ speed difference between each engine the system is triggered.

(6) Make sure the APR green annunciator comes ON.

(7) Close throttle so that both engines are at idle setting.

(8) Make sure both engines $N_2$ rpm are stable.

(9) Press ARM switch (to disarm system) and make sure that both engines $N_2$ rpm reduce by about 1%.

(10) Make sure both APR annunciators are OFF.

(11) Observe reading of APR EVENT counter, it should not have altered during this test (Pre-Mod.252719).

*NOTE: Mod.252719 deletes the EVENT counter, 90° throttle switch and wiring.*

## 5. Fire drills - unpressurized airplane

**WARNING: BROMOCHLORODIFLUOROMETHANE IS OF LOW TOXICITY BUT IT HAS AN OBNOXIOUS ODOUR AND, IN CONTACT WITH FIRES, BECOMES SLIGHTLY MORE TOXIC; AVOID INHALING IT.**

**A. Primary actions**

*NOTE: This drill is applicable to warnings of engine fire or rear equipment bay overheat.*

(1) HP fuel cock(s). OFF.

*NOTE: On completion of paragraph (1), if warning does not persist, ignore remainder of drill.*

| | | |
|---|---|---|
| (2) | LP fuel cock(s). | OFF. |
| (3) | APU master switch. | OFF. |
| (4) | WING FUEL X-FEED/TRANSFER selector. | Up position. |
| (5) | AUX FUEL TRANSFER selector. | Up position. |
| (6) | ENG 1 or 2 EXT switch | SHOT 1, if warning persists select SHOT 2 |
| | *NOTE: Observe operation of EXT FIRED indicators.* | |
| (7) | If emergency persists, establish radio contact. | Request assistance. |
| (8) | BATTERY switch. | OFF. |
| (9) | Advise external crew members | External crew actions:<br>(a) Disconnect external electrical power<br>(b) Investigate suspected external fires, attract help and complete 'Secondary Actions', as necessary.<br>(c) Advise internal crew members as necessary. |
| (10) | One internal crew member | Investigate suspected internal fires and combat, using airplane portable extinguisher, as necessary. |

### B. Secondary actions

**WARNING: AVOID DIRECT CONTACT BETWEEN THE PERSON AND METALLIC PARTS OF A DISCHARGING $CO_2$ EXTINGUISHER. DO NOT INHALE $CO_2$.**

**WARNING: DO NOT APPLY FOAM EXTINGUISHANT TO ENGINE AIR INTAKE OR EXHAUST UNIT UNLESS ABSOLUTELY NECESSARY. FOAM TYPE EXTINGUISHANT MAY SERIOUSLY CORRODE POWER PLANT.**

(1) Fight fires using ground extinguishers.

## 6. Fire drills - pressurized airplane

**WARNING: DO NOT ATTEMPT TO DEPRESSURIZE RAPIDLY.**

**WARNING: BROMOCHLORODIFLUOROMETHANE IS OF LOW TOXICITY BUT IT HAS AN OBNOXIOUS ODOUR AND, IN CONTACT WITH FIRE, BECOMES SLIGHTLY MORE TOXIC; AVOID INHALING IT.**

### A. Primary actions

*NOTE: This drill is applicable to warnings of engine fire or rear equipment bay overheat.*

| | | |
|---|---|---|
| (1) | MAIN AIR VALVE(s). | CLOSE. |

**WARNING: DO NOT ATTEMPT TO DEPRESSURIZE RAPIDLY.**

| | | |
|---|---|---|
| (2) | PRESSN GEAR SW. | AUTO. |
| (3) | HP fuel cock(s). | OFF. |

*NOTE: On completion of paragraph (3) if warning does not persist, ignore remainder of drill except for paragraph (12).*

| | | |
|---|---|---|
| (4) | LP fuel cock(s). | OFF. |
| (5) | APU master switch. | OFF. |
| (6) | WING FUEL X-FEED/TRANSFER selector. | Up position. |
| (7) | AUX FUEL TRANSFER selector. | Up position. |
| (8) | ENG 1 or 2 EXT switch. | SHOT 1, if warning persists select SHOT 2. |

*NOTE: Observe operation of EXT FIRED indicators.*

| | | |
|---|---|---|
| (9) | If emergency persists, establish radio contact. | Request assistance. |
| (10) | Advise external crew members. | External crew actions:<br>(a) Disconnect external electrical power.<br>(b) Investigate suspected external fires, attract help and complete 'Secondary Actions', as necessary.<br>(c) Advise internal crew members, as necessary. |
| (11) | BATT switch. | OFF. |
| (12) | All internal crew members. | Put on smoke masks. |

**WARNING: BROMOCHLORODIFLUOROMETHANE IS OF LOW TOXICITY BUT IT HAS AN OBNOXIOUS ODOUR AND, IN CONTACT WITH FIRE, BECOMES SLIGHTLY MORE TOXIC; AVOID INHALING IT.**

| | | |
|---|---|---|
| (13) | One internal crew member. | Investigate suspected internal fires and combat, using airplane portable extinguisher, as necessary. |
| (14) | DUMP VALVE selector | Slowly to OPEN |

B. **Secondary actions**

**WARNING: AVOID DIRECT CONTACT BETWEEN THE PERSON AND METALLIC PARTS OF A DISCHARGING $CO_2$ EXTINGUISHER. DO NOT INHALE $CO_2$.**

**CAUTION: DO NOT APPLY FOAM EXTINGUISHANT TO ENGINE AIR INTAKE OR EXHAUST UNIT UNLESS ABSOLUTELY NECESSARY. FOAM TYPE EXTINGUISHANT MAY SERIOUSLY CORRODE POWER PLANT.**

(1) Fight fires using ground extinguishers.

# COWLINGS
# DESCRIPTION

## 1. General *(Figure 1 and Figure 2)*

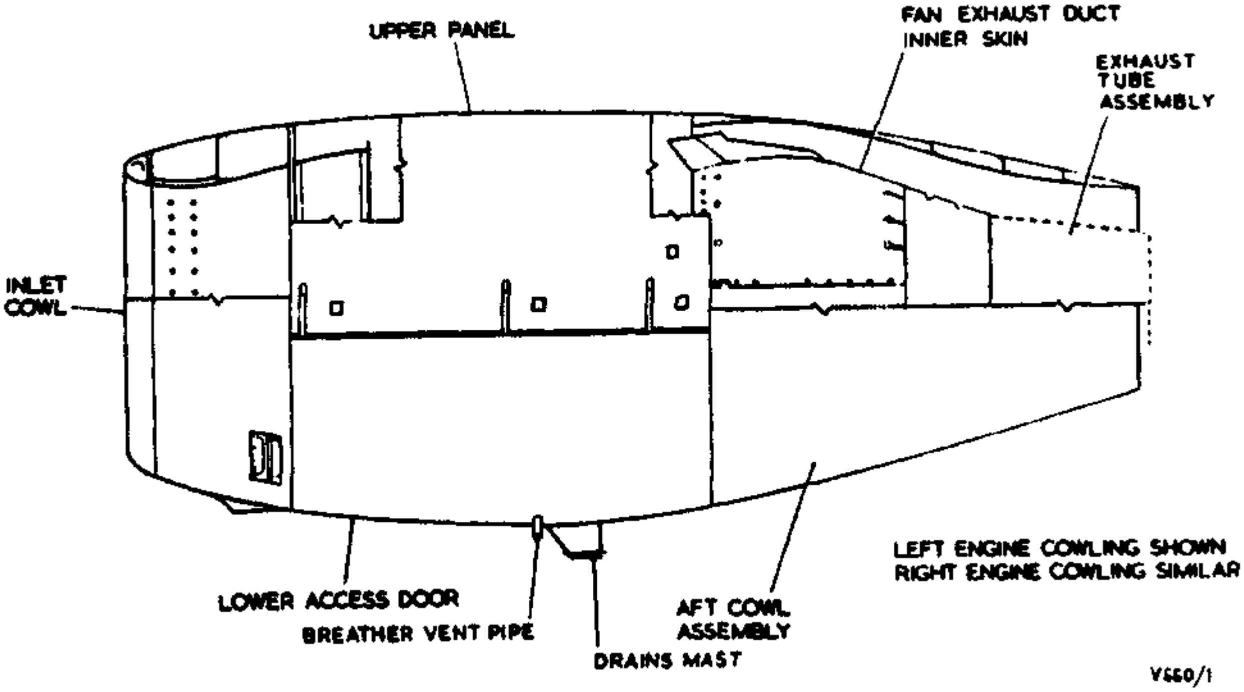
The power plant is enclosed within four main cowlings, an inlet cowl, an upper panel and lower access door, and an aft cowl assembly. The inlet and aft cowls are bolted direct to the engine front and rear flanges respectively and form the foundation for the installation of the upper panel and lower access door. Included in the engine surround items, but not strictly within the cowling concept, are a rear mount fairing, fan exhaust duct inner skin assembled as top and bottom panels and an exhaust tube assembly incorporating a jet pipe.

## 2. Inlet cowl

The inlet cowl is bolted to the engine forward flange and forms the engine air intake. The cowl is of conventional skin/frame/stringer design consisting of an intake lip joined to an inner and outer skin supported by three hoop frames. The space between the inner and outer skin is used as an anti-icing distribution duct. The aft frame provides the forward land for the upper panel and lower access door, and the forward firewall for zone 1.

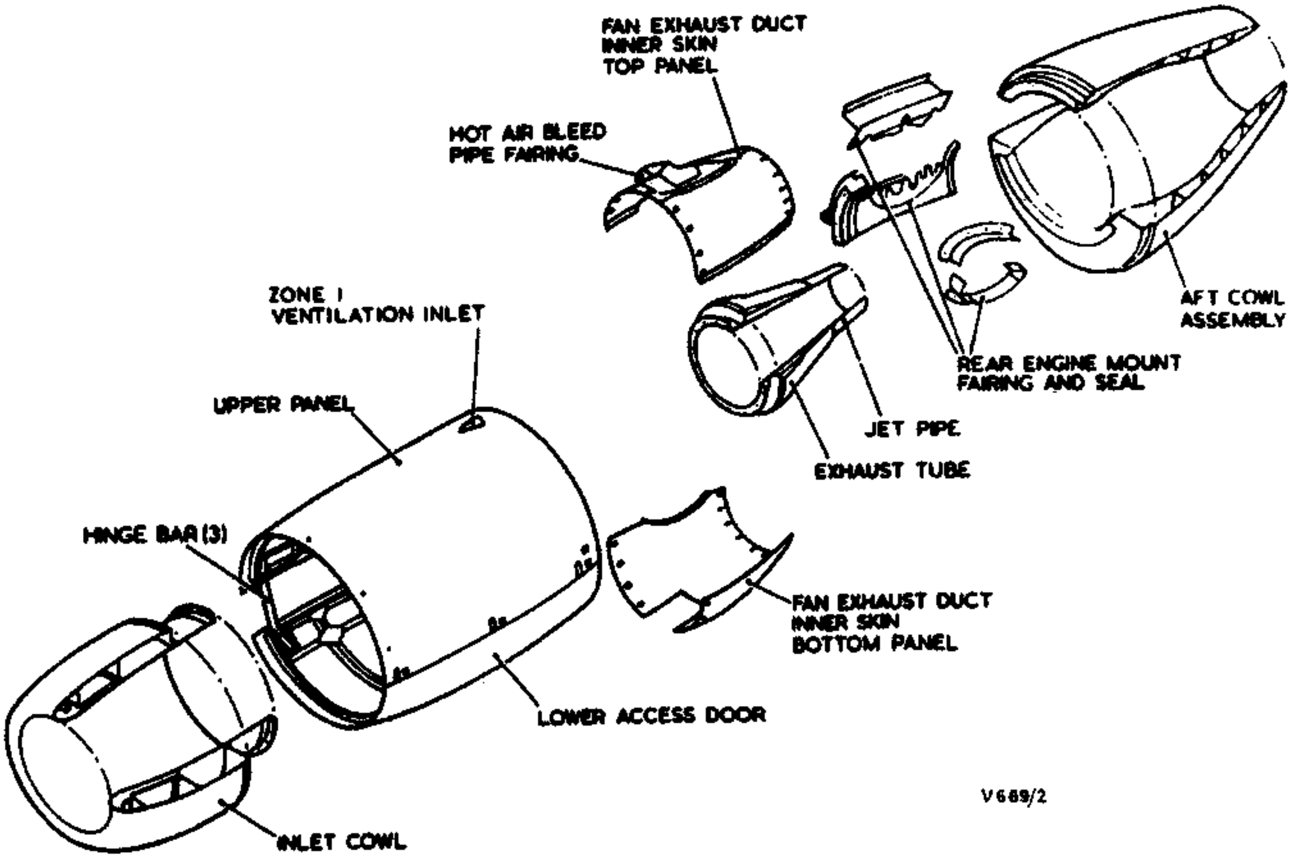
Since the cowl duct between the forward firewall and the cowl/engine front flange is in engine zone 1 it is insulated by two half blankets laced to each other by stainless steel wire.

All structure is light alloy except for the cowl lip, forward and aft frames, inner skin and the anti-icing system ducts which are stainless steel. Adhesive metal to metal bonding is utilized in addition to riveting in the areas subject to high sound pressure levels.



Cowlings - general

*Figure 1*



Cowling details

*Figure 2*

The inlet cowl is anti-iced with HP air from the engine. The air is ducted to a piccolo tube, within the cowl lip, in which small holes distribute the hot air round the cowl lip internal surface and rearwards along the distribution duct, formed by the double skin, to exhaust overboard through louvres in the external side skin.

An air inlet scoop and duct in the bottom of the cowl provides cooling air for the engine starter/generator.

## 3. Upper panel

The upper panel provides access, after removal of the lower access door, to the entire upper half of the engine. It attaches at the forward edge to the inlet cowl with screws and at the aft edge to the aft cowl assembly with two quick-release shear pins. The shear pins permit unrestrained fore and aft movement of the aft cowl assembly due to engine growth. The upper cowl panel supports the lower access door by latches on the inboard edge and by hinges on the outboard edge.

The panel consists of a one piece milled skin reinforced with frames and stringers, mounting latch support posts, hinges and latches and an engine zone 1 air inlet. The inlet feeds ram air to ventilate the engine zone 1 and in so doing provides a cooling air supply to feed an a.c. generator on the right engine and, Mod.256820, an a.c. generator on the left engine.

All materials are light alloy except the latch support posts, quick-release pins and several stringers, which are steel. Fire containment is provided along the inboard side, consisting of 0.005 in. thick stainless steel foil mounted between the skin and panel frame sub-structure.

## 4. Lower access door

The lower access door is the main access to the accessory section (zone 1) of the engine. It is mounted on the upper panel with hinges on the outboard side and by hook type latches on the inboard side. The door may be supported in the open position by jury struts, and besides giving complete access to the lower half of the engine also serves as an umbrella, protecting both the engine and service crew.

The door consists of a one-piece milled skin, frames and stringers, hinge fittings, hooks and latches. It incorporates flush starter/generator cooling air exhaust adapter and seal, breather vent pipe, engine drains scupper and mast, ventilation exit louvre and spring-loaded viewing ports.

The right engine door also incorporates an a.c. generator flush fitting cooling air exhaust adapter and seal. Mod.256820 a similar arrangement is embodied in the left engine door.

Fire containment is provided along the inboard side by 0.005 in. thick stainless steel foil mounted between the aluminium skin and door frame sub-structure.

Spring-loaded viewing ports are provided for preflight inspection of the oil and fuel filter indicators so that the main access door need not be opened. A slat in the right door and a spring-loaded viewing port in the left door allows viewing of the oil tank oil level sight glass. To fill the oil tank, however, the lower access door has to be opened.

## 5. Aft cowl assembly

The aft cowl assembly surrounds the combustor case and the exhaust tube assembly of the engine. The forward frame provides the aft land for the upper panel and lower access door and the aft firewall for zone 1. Attachment to the engine fan duct rear flange is by bolts.

Light alloy is used to fabricate the skins, frames and intercostals except the forward frame (zone 1 aft firewall) which is stainless steel. The assembly components consist of an external skin, fan exhaust duct outer skins, fan flange mounting and a dual ignition plug access door, in both skins. Also incorporated are a cut-out in the inboard side for the engine rear mount fairing, a drain tube for the combustor drains and rear mount outer panels. The fan exhaust duct outer skin of the cowl is made in one piece to improve fatigue life.

The aft cowl assembly can be removed with the engine in-situ to gain access to the fan duct inner skin, turbine exhaust tube, HP duct fairing, rear mount fairing and rear engine mount.

## 6. Fan inner skin assembly

This assembly surrounds the combustor and fuel manifold portions of the engine and consists of upper and lower light alloy skins. The upper skin and lower skin are assembled to each other with screws along the horizontal center-line and attach to the engine at the forward edge with screws. The aft edge of the upper and lower skin assemblies rest on the skirt frame of the turbine exhaust providing a slip and expansion joint.

The fan inner skin assemblies, although constructed of light alloy, provide a firewall about the zone 2 section of the engine by virtue of the ventilation and cooling air flow. Cooling and ventilation is provided by a row of holes at the forward end of the skins, which takes air from the fan exhaust duct, circulates it between the engine and the skins, then exhausts it back into the fan exhaust stream through the slats in the aft edge of the skins.

A steel fairing for the HP air bleed duct is mounted on the top center-line of the upper fan inner skin assembly. A portion of this fairing is removable, to provide access to the transfer tube. The lower fan inner skin assembly contains an access for the second igniter plug. Drain holes are also provided in the event of fuel/oil leaks.

## 7. Rear mount fairing and structure assembly

The rear mount fairing enshrouds the rear mount, high pressure air bleed pipe, fire sensor wire and fuel computer services where they pass across the engine fan exhaust duct. The fairing, assembled in halves, is located on two profiled angles on the fan exhaust duct inner skin and is attached to an upper panel and lower panel assembly which, in turn, is secured to the aft cowl inner skin and to the engine fan duct rear flange.

Within the fairing is an assembly comprising two fire seals abutted on each side by two vertically opposed titanium shields. The seals/shields are bolted to the upper panel and lower panel assembly which in turn are closed by top and bottom outer panels secured to the aft cowl outer skin.

## 8. Pylon pressurization

An adapter secured to the lower panel assembly outer face incorporates a short flexible pipe which protrudes into the pylon. This feeds engine fan exhaust duct air to pressurize the pylon and prevent the ingress of possible fuel vapours from engine zone 1 and thus minimize fire risk around the high pressure air bleed pipe and its associated mixer valve.

## 9. Exhaust tube and skirt assembly

The exhaust tube and skirt assembly is a stainless steel exhaust tube and separate slip-on skirt assembly which forms the aft portion of the fan inner skin. The assembly is attached to the engine turbine exhaust flange by a radial V-type clamp and the skirt slides up to the pipe to the fan duct inner skin assembly.

## 10. Pylon

The all metal pylons are built-up structures which protrude horizontally from each side of the rear fuselage and house the power plant mounts and services.

The upper and lower skins, webs and power plant forward yoke mount are of titanium and the power plant rear mount bracket is of stainless steel. A fireproof bulkhead at each end of ZONE 1 is incorporated. Forward and aft of this zone the power plant nacelle pod butts against sealing strips on the pylon.

Quick release access panels in the top and lower skins provide access to the power plant rear attachment bolts and to system disconnect points.

The pylon which is pressurized has a pressure relief door, hinged at the forward end and retained closed by a spring-loaded latch at the rear end, incorporated in each of the top and lower pylon skins.

# COWLINGS
# SERVICING

## 1. Replace engine breather pipe seal on lower access door

| Equipment/Material | Part/Item No. |
|---|---|
| Seal (Engine breather) | F10A-5-P100-44-11 |
| Adhesive (USA) (Seal and access door) | EC 2126 |
| Adhesive (UK/Europe) (Seal and access door) | EC 776 |
| Cleaning agent | Ethyl Acetate |
| Cleaning agent | Item 204 (Chapter 20-95-201) |

### A. Procedure

(1) With the lower access door open, remove and discard the seal.

(2) Remove all traces of oil and old adhesive from the seal mounting on the lower access door using the correct solvent (refer to materials).

(3) Coat the seal mounting and one side of the seal with adhesive.

(4) Allow the applied adhesive to become tacky.

*NOTE: This will be approximately 10-15 minutes for adhesive EC 776 or 15-20 minutes for EC 2126.*

(5) Locate and contact the seal with its mounting making sure that its bore is concentric with the breather orifice on the engine.

(6) Close the lower access door and make sure the seal is concentric with the engine breather pipe.

(7) Open the lower access door and allow the adhesive to dry (approximately 30 minutes).

# COWLINGS
# REMOVAL/INSTALLATION

## 1. Lower access door

### A. Removal *(Figure 401)*

(1) Unlatch the lower access door from the upper panel by the inboard latches.

*NOTE: The latches are levered outward using a screwdriver, approximately 3 in. long, inserted in the facia slot.*

(2) Unlatch the door hinges (outboard side) and remove the lower access door.

*NOTE: The hinge latches are levered outward using a piece of 0.25 in. rod inserted in the facia hole.*

### B. Installation *(Figure 401)*

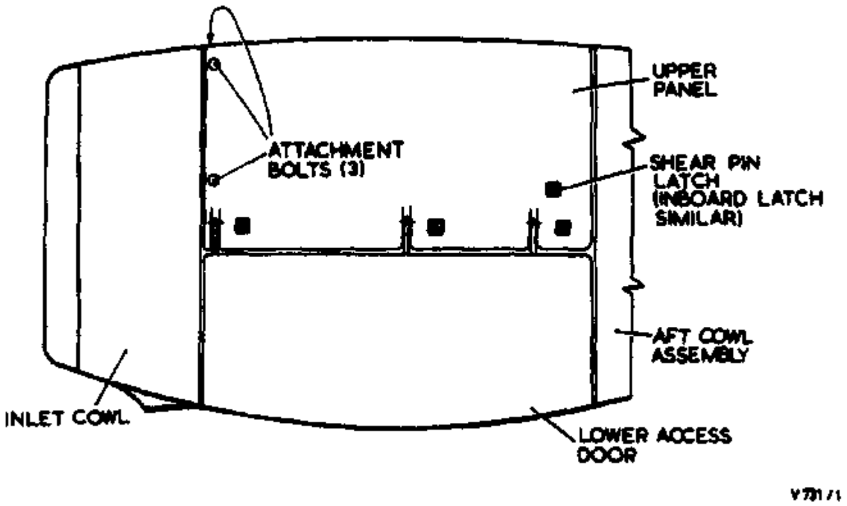
(1) Position the lower access door up to the hinge fittings on the outboard side of the upper access panel. Close the hinge latches.

(2) Close the door up to the upper access panel latches and push in the latches.

(3) Make sure that the door latches are up tight. Adjust the inboard latches if necessary (ADJUSTMENT/TEST).

(4) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe orifice (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (SERVICING).*



Access panel attachments
*Figure 401*

## 2. Upper Panel

### A. Removal *(Figure 401)*

(1) Remove the lower access door (paragraph 1.A.).

(2) Remove the bolts securing the forward periphery of the upper panel to the aft edge of the inlet cowl.

(3) Release the panel two quick-release shear pins from the aft cowl assembly and remove the panel making sure that its hinge bars to not damage the adjacent electrical looms.

*NOTE: The shear pin latches are levered outward using a suitable tool inserted in the facia hole.*

### B. Installation *(Figure 401)*

(1) Locate the upper panel on the engine making sure that its hinge bars do not damage adjacent electrical looms.

(2) Align the bolt holes (3 off) in the forward edge of the panel. Install the securing bolts but do not tighten at this stage.

(3) Align the panel shear pins (2 off) with their assembly housing on the aft cowl assembly and close the shear pin latches.

(4) Tighten the panel securing bolts installed in paragraph (2).

(5) Install lower access door (paragraph 1.B.).

## 3. Aft cowl assembly *(Figure 402, Figure 403, Figure 404)*

### A. Removal

(1) Remove the access panel from the pylon top and bottom skin at the engine rear mount.

(2) Remove the lower access door (paragraph 1.A.).

(3) Remove the upper panel (paragraph 2.A.).

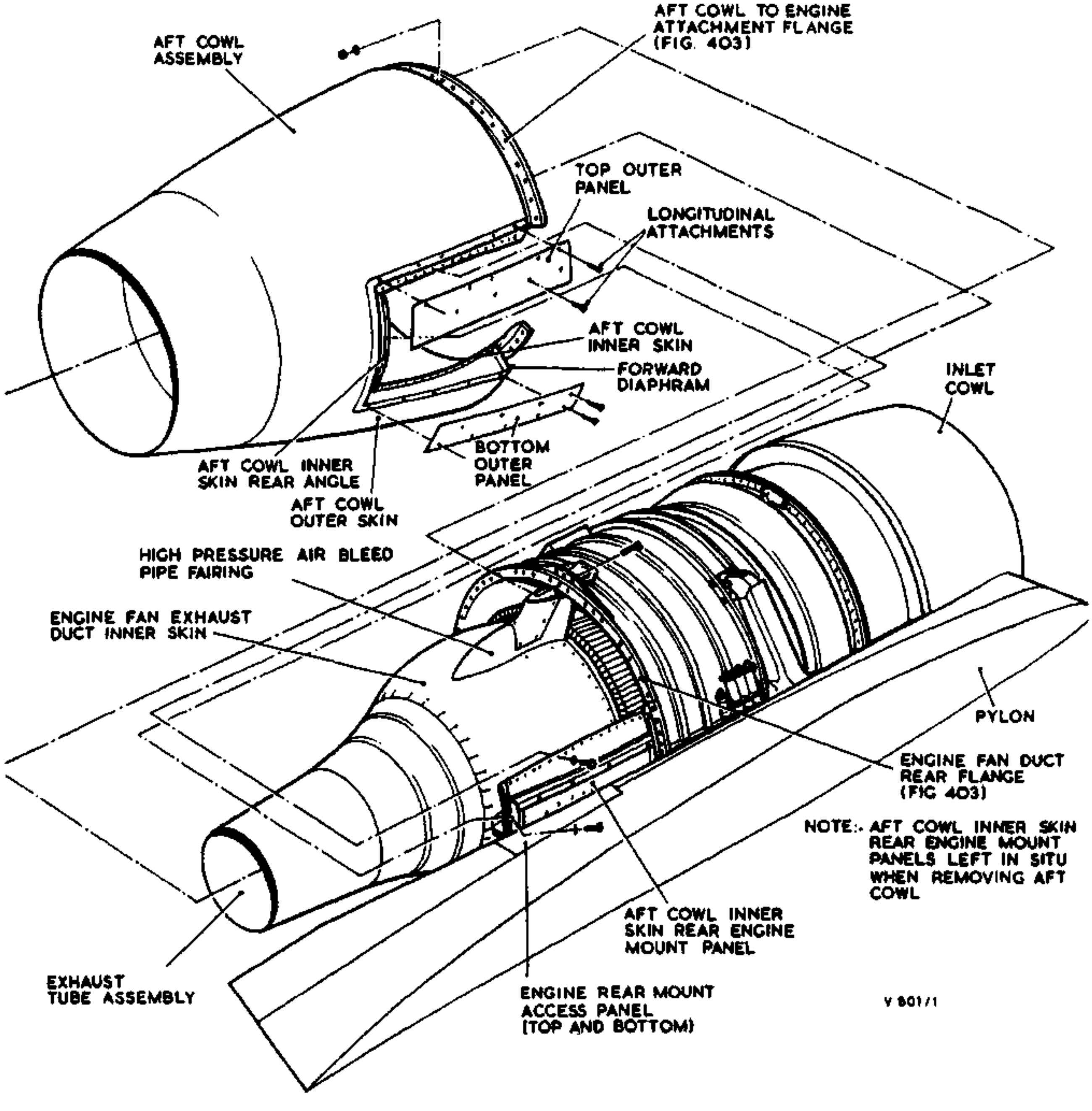
(4) Remove the bolts from the top and bottom outer panels *(Figure 404)* closing the aft cowl outer skin about the engine rear mount.

(5) Disconnect the upper panel and lower panel assembly from the aft cowl inner skin.

  (a) Remove the bolts and washers attaching the upper panel and lower panel assembly to the rear angle on the aft cowl inner skin.

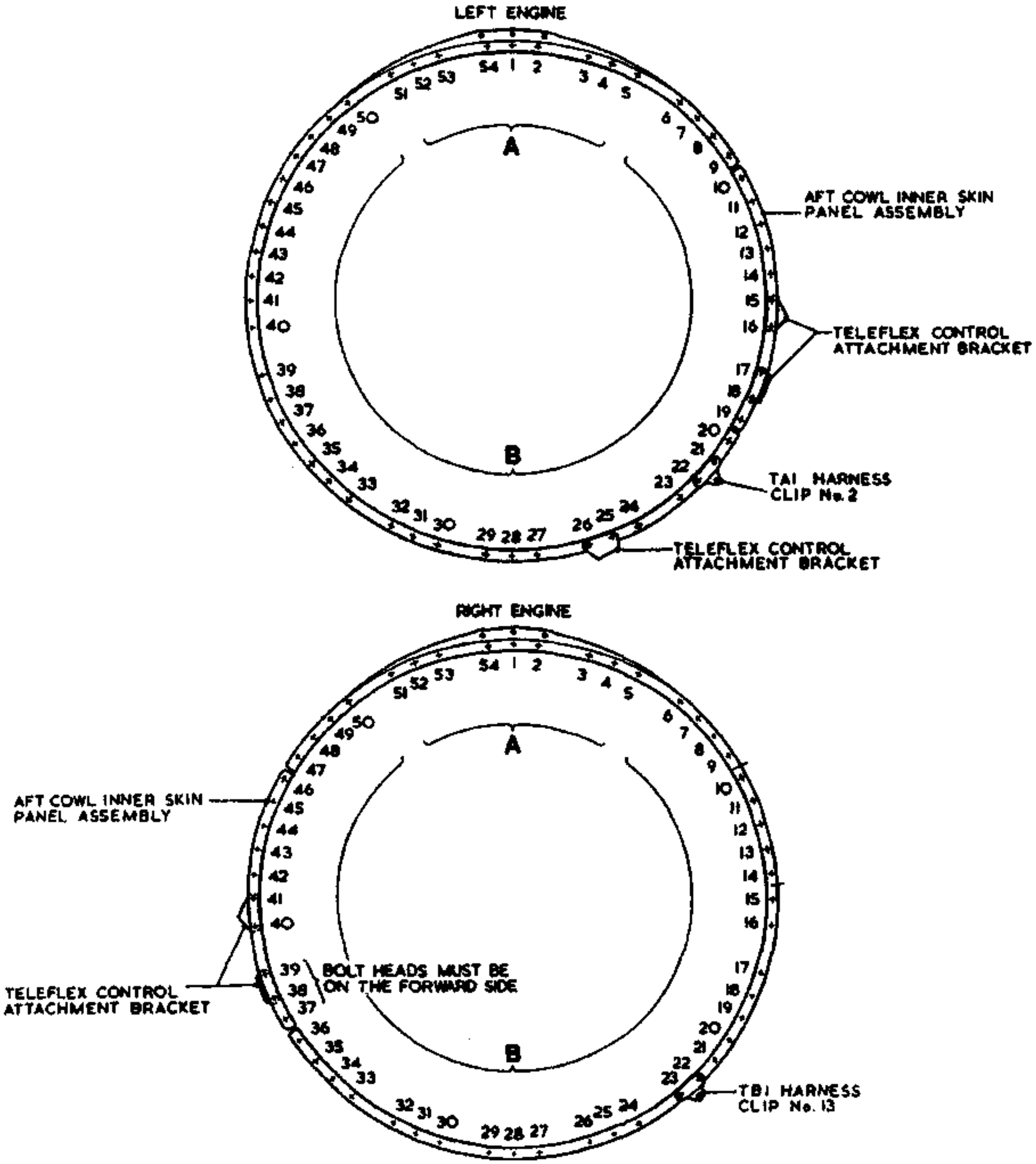
  (b) Remove the bolts from along the longitudinal edges of the upper panel and lower panel assembly at attachment to the aft cowl inner skin.

  *NOTE: The inner skin panels are disconnected, not removed.*


AFT COWL ASSEMBLY
AFT COWL TO ENGINE ATTACHMENT FLANGE (FIG. 403)
TOP OUTER PANEL
LONGITUDINAL ATTACHMENTS
AFT COWL INNER SKIN
FORWARD DIAPHRAM
INLET COWL
BOTTOM OUTER PANEL
AFT COWL INNER SKIN REAR ANGLE
AFT COWL OUTER SKIN
HIGH PRESSURE AIR BLEED PIPE FAIRING
ENGINE FAN EXHAUST DUCT INNER SKIN
PYLON
ENGINE FAN DUCT REAR FLANGE (FIG 403)
NOTE:- AFT COWL INNER SKIN REAR ENGINE MOUNT PANELS LEFT IN SITU WHEN REMOVING AFT COWL
AFT COWL INNER SKIN REAR ENGINE MOUNT PANEL
EXHAUST TUBE ASSEMBLY
ENGINE REAR MOUNT ACCESS PANEL (TOP AND BOTTOM)
V 801/1

Aft cowl removal

*Figure 402*


LEFT ENGINE
A
B
AFT COWL INNER SKIN PANEL ASSEMBLY
TELEFLEX CONTROL ATTACHMENT BRACKET
TAI HARNESS CLIP No. 2
TELEFLEX CONTROL ATTACHMENT BRACKET
RIGHT ENGINE
A
B
AFT COWL INNER SKIN PANEL ASSEMBLY
TELEFLEX CONTROL ATTACHMENT BRACKET
BOLT HEADS MUST BE ON THE FORWARD SIDE
TBI HARNESS CLIP No. 13

BOLT LOCATIONS (LOOKING FORWARD)

| HOLE REFERENCE No | BOLT | |
|---|---|---|
| | DIA | GRIP LENGTH |
| A {1 – 5<br>51 – 54} | 10/32 UNF | 0.562 IN |
| B 6 – 50 | 10/32 UNF | 0.312 IN |

WASHERS FITTED TO ALL BOLTS

V764/1

Aft cowl attachment locations

*Figure 403*

(6) Disconnect the electrical leads and pipes from their clips on the aft cowl forward diaphragm *(Figure 403)*.

(7) Remove the nuts, bolts and washers, from the aft cowl attachment to the engine fan duct rear flange, except at attachment locations numbered 10 to 19, left engine, or 37 to 46, right engine, *(Figure 403)*. These secure the engine rear mount fairing and cowl inner skin panels to the flange.

*NOTE: The aft cowl inner skin rear engine mount panels are left in-situ on the engine when removing the aft cowl assembly.*

(8) Remove the aft cowl assembly rearward.

**B. Installation** *(Figure 402, Figure 403, Figure 404, Figure 405)*

(1) Hoop the aft cowl assembly over the exhaust tube, up to the engine fan duct rear flange. Make sure that the rear engine mount fairing aligns with the upper panel and the lower panel assembly.

(2) Attach the aft cowl to the engine fan duct rear flange with the bolts, nuts and washers - the bolt heads forward. Make sure the bolts are installed in the correct location according to bolt grip length, as shown on *Figure 403*. Torque load bolts to 30-35 lbf/in.

(3) Secure the electrical leads and pipes to their clips on the aft cowl front diaphragm.

(4) Bolt the upper panel and lower panel assembly *(Figure 404)* to the cowl inner skin (refer to *Figure 405* for attachment bolt details).

(5) Bolt the top and bottom outer closing panels to the aft cowl outer skin.

(6) Install the access panels in the pylon top and bottom skin above and below the rear engine mount.

(7) Install the upper panel (paragraph 2.B.).

(8) Install the lower access door (paragraph 1.B.).

## 4. Engine rear mount fairing

**A. Removal** *(Figure 404 and Figure 405)*

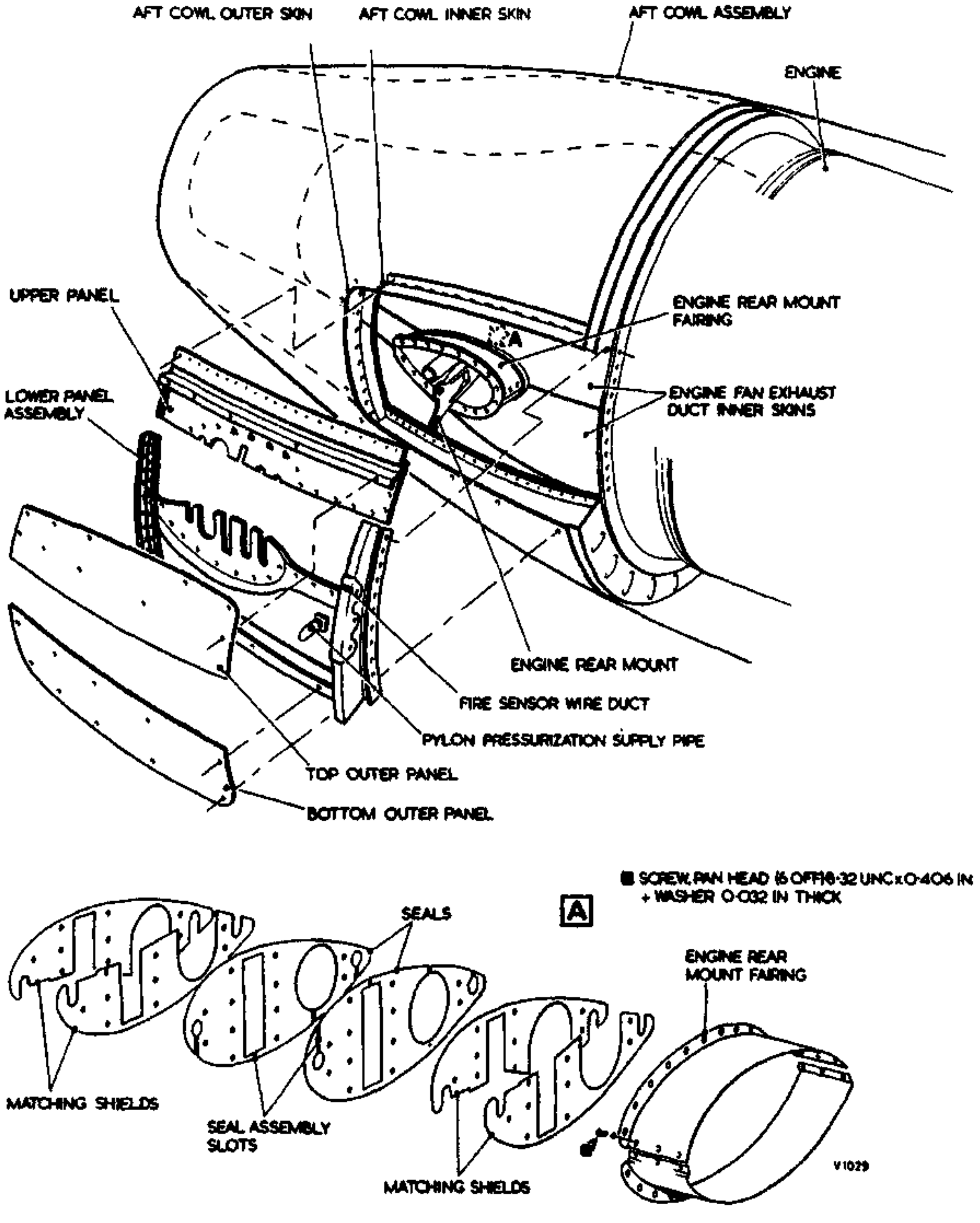
(1) Remove the aft cowl assembly (paragraph 3.A.).

(2) Remove the screws (23 off) securing the upper and lower halves of the rear mount fairing to the cowl inner skin panels, and remove the fairings.

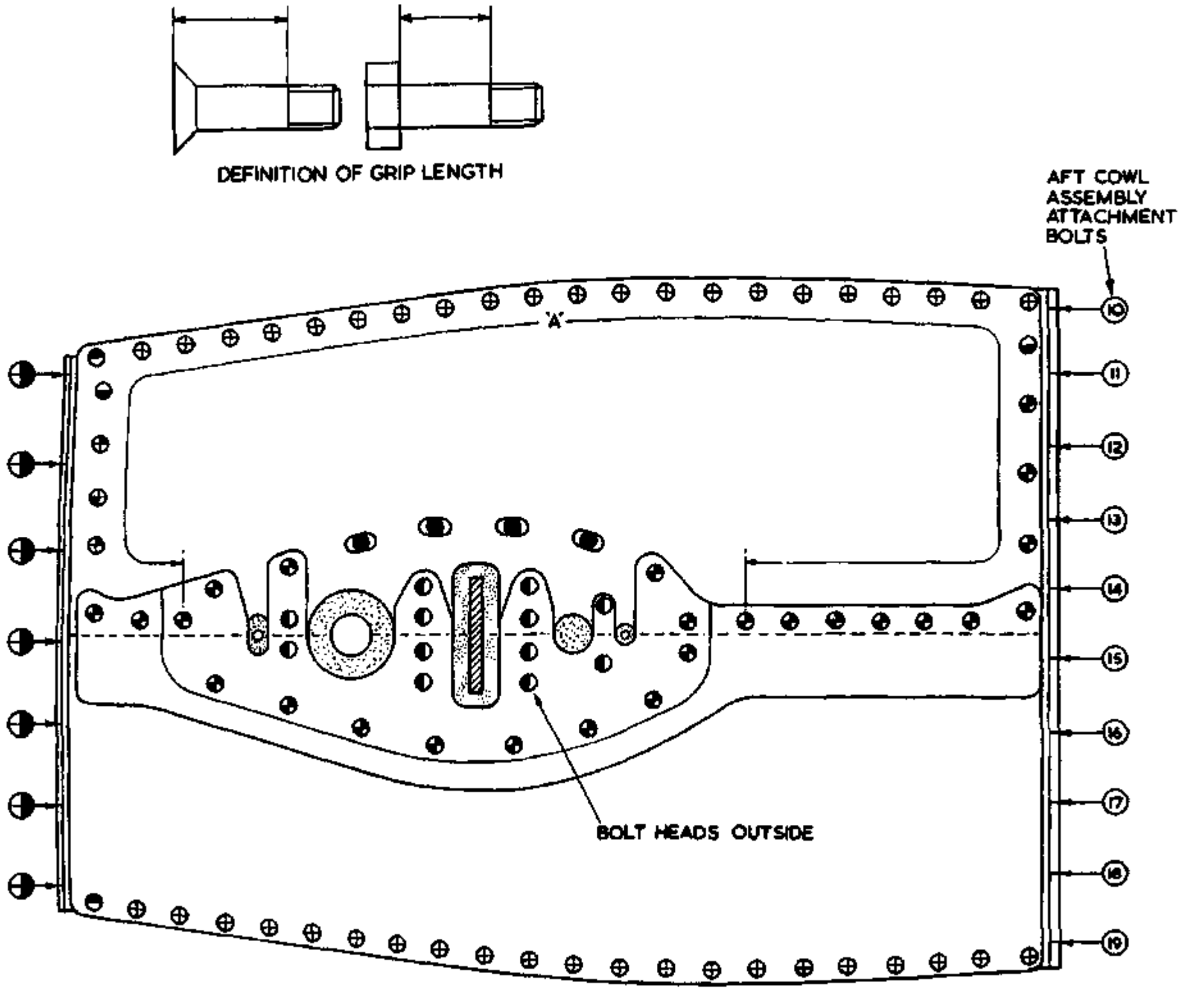
(3) Remove shields (4 off) and seals (2 off) from the upper panel and lower panel assembly (12 bolts and nuts).

(4) Unbolt the fire sensor wire duct mounting bracket.

(5) Remove the bolts securing the upper panel to the lower panel assembly, separate and remove the upper panel.



Engine rear mount fairing removal
*Figure 404*



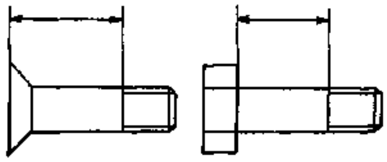
| | |
|---|---|
| ● | SCREW-CSK-10-32 UNF × 0.18 IN |
| ◒ | SCREW-CSK-10-32 UNF × 0.23 IN + THIN WASHER + LOCKNUT |
| ⊕ | SCREW-CSK-10-32 UNF × 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT |
| ⊕ | SCREW-CSK-10-32 UNF × 0.23 IN + LOCKNUT |
| ◕ | SCREW-CSK-10-32 UNF × 0.23 IN |
| ◐ | BOLT-HEX HD-10 UNF 2A × 0.50 IN + LOCKNUT |
| ⊕ | BOLT-HEX HD-10-32UNF × 0.250 IN + THIN WASHER |
| ◓ | BOLT-HEX HD-10-32UNF × 0.312 IN + THIN WASHER |
| ◑ | BOLT-HEX HD-10-32UNF × 0.125 IN |

BOLT / SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

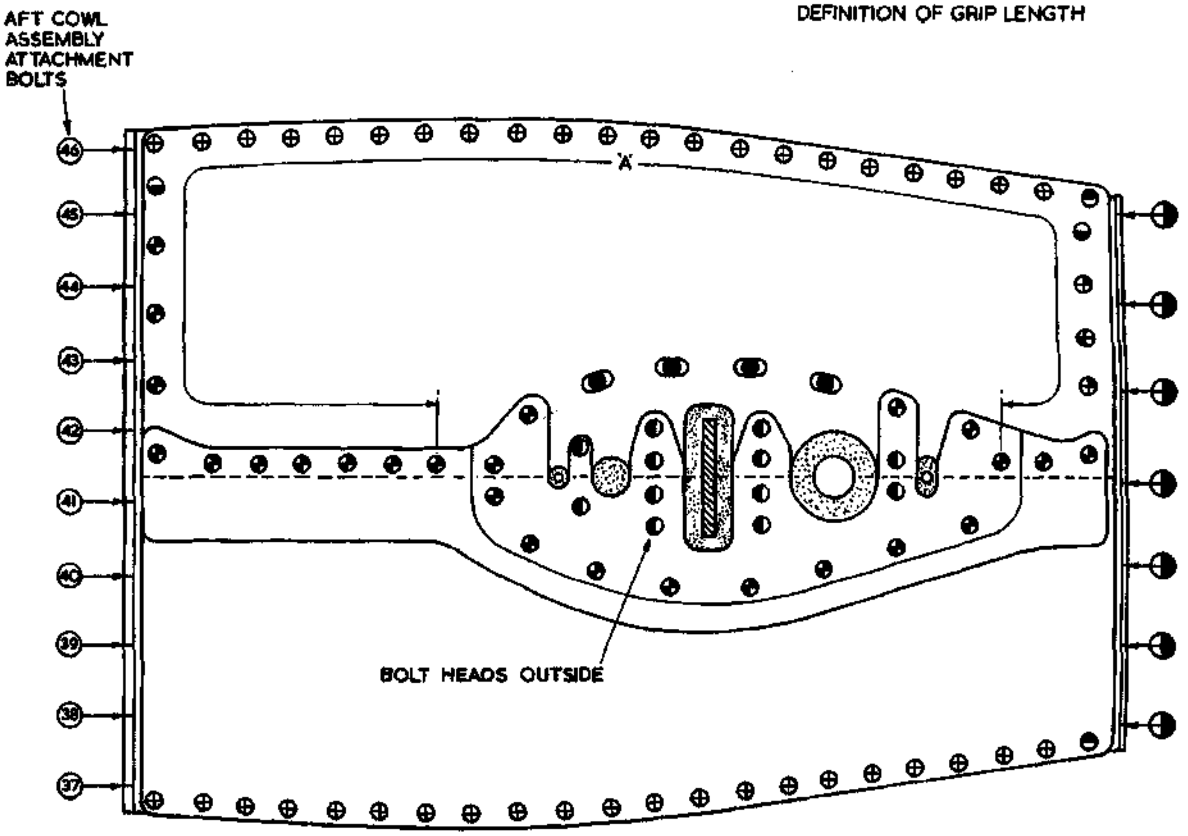
NOTE
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

V1036
HA00B969067AA

Disposition of engine rear mount
fairing attachment - left
*Figure 405 (Sheet 1 of 2)*



DEFINITION OF GRIP LENGTH



- ● SCREW-CSK-10-32UNF × 0.18 IN
- ◒ SCREW-CSK-10-32UNF × 0.23 IN + THIN WASHER + LOCKNUT
- ◔ SCREW-CSK-10-32UNF × 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT
- ◶ SCREW-CSK 10-32UNF × 0.23 IN + LOCKNUT
- ◕ SCREW-CSK-10-32UNF × 0.23 IN
- ◐ BOLT-HEX HD-10UNF 2A × 0.50 IN + LOCKNUT
- ⊕ BOLT-HEX HD-10-32UNF × 0.250 IN + THIN WASHER
- ◓ BOLT-HEX HD-10-32UNF × 0.312 IN + THIN WASHER
- ◑ BOLT-HEX HD-10-32UNF × 0.125 IN

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

NOTE
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

V1037
HA00B089069AA

Disposition of engine rear mount
fairing attachment - right
*Figure 405 (Sheet 2 of 2)*

(6) Remove the bolts/nuts/washers securing the lower panel assembly to the engine fan duct rear flange (bolts 10-19 left) or 37-46 (right) and remove the panel assembly.

*NOTE: Do not distort the fire sensor wire when removing the lower panel assembly.*

### B. Installation

(1) Assemble the lower panel to the engine fan duct rear flange with the bolts, nuts and washers - bolt heads forward. Make sure that the pylon pressurization supply pipe end is correctly located in the pylon structural web.

(2) Torque tighten bolts to 30-35 lbf/in.

(3) Bolt the upper panel to the lower panel assembly using bolts 'A' *(Figure 405).*

(4) Mount one seal across the pipes/engine mount with its assembly splits lowermost and the second seal with its assembly splits uppermost.

(5) On each side of the seals assemble one shield with its slots lowermost and the other shield with its slots uppermost retain the parts in that condition.

(6) Stabilize the shields and seals using 12 bolts and nuts with the bolt heads outside and tighten the nuts.

(7) Bolt the engine rear mount lower fairing to the lower panel assembly.

(8) Bolt the engine rear mount upper fairing to the lower fairing and to the upper panel.

(9) Locate and bolt up the fire sensor wire duct mounting bracket.

(10) Install aft cowl assembly (paragraph 3.B.).

## 5. Fan exhaust duct inner skin panels *(Figure 406)*

### A. Removal

(1) Remove the aft cowl assembly (paragraph 3.A.).

(2) Remove the engine rear mount fairing assembly (paragraph 4.A.).

(3) Remove the fan exhaust duct inner skin top panel.

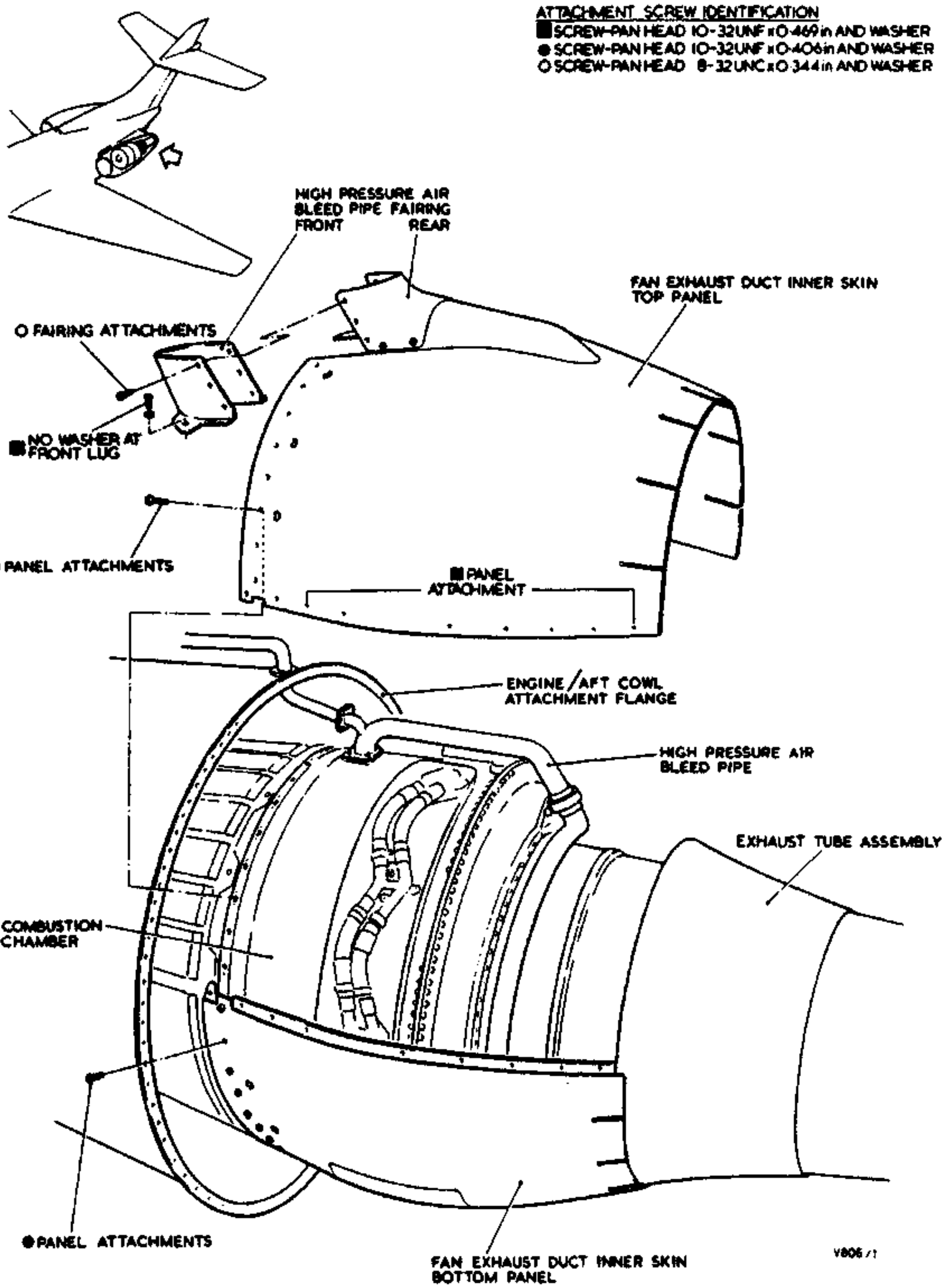
(a) Remove the screws, or screws and washers, securing the high-pressure bleed pipe fairings to the top panel.

(b) Remove the front and rear fairings from about the bleed pipe.

(c) Remove the screws and washers from around the top panel forward periphery.

(d) Remove the screws and washers from the skin panels longitudinal lap joints.

(e) Remove the fan exhaust duct inner top skin panel.


ATTACHMENT SCREW IDENTIFICATION
■ SCREW-PAN HEAD 10-32UNF x 0.469in AND WASHER
● SCREW-PAN HEAD 10-32UNF x 0.406in AND WASHER
○ SCREW-PAN HEAD 8-32UNC x 0.344in AND WASHER
HIGH PRESSURE AIR BLEED PIPE FAIRING
FRONT
REAR
FAN EXHAUST DUCT INNER SKIN TOP PANEL
○ FAIRING ATTACHMENTS
■ NO WASHER AT FRONT LUG
● PANEL ATTACHMENTS
■ PANEL ATTACHMENT
ENGINE/AFT COWL ATTACHMENT FLANGE
HIGH PRESSURE AIR BLEED PIPE
EXHAUST TUBE ASSEMBLY
COMBUSTION CHAMBER
● PANEL ATTACHMENTS
FAN EXHAUST DUCT INNER SKIN BOTTOM PANEL
V806/1

Fan exhaust duct inner skin panels removal

*Figure 406*

(4) Remove the screws and washers from the bottom panel forward periphery and remove the bottom panel.

### B. Installation

*NOTE: Tighten all screws attaching the fan exhaust duct inner skin panels progressively in sequence. Do not fully tighten any screw with other screws loose or missing.*

(1) Position the fan exhaust duct inner skin bottom panel to the combustion chamber and secure round the forward periphery with screws and washers.

*NOTE: Be careful not to foul the fire detection system.*

(2) Lower the inner skin top panel onto the combustion chamber and add the bottom panel. Attach the top panel to the bottom panel, along the horizontal joint, using screws and washers.

(3) Attach the high-pressure air pipe front and rear fairing to the top skin panel and each other with screws, or screws and washers.

(4) Make sure that the assembled fan exhaust duct inner skin panels fit snug round the exhaust tube assembly and that all air holes and slots are unobstructed.

## 6. Exhaust pipe and tube assembly *(Figure 407)*

### A. Removal

(1) Remove the lower access door (paragraph 1.A.).

(2) Remove the upper panel (paragraph 2.A.).

(3) Remove the aft outer cowl assembly (paragraph.3.A.).

(4) Remove the engine rear mount fairing (paragraph 4.A.).

(5) Remove the fan exhaust duct inner skin panels (paragraph 5.A.).

(6) Unscrew the exhaust pipe clamp T-bolt self-sealing high temperature, nuts and remove the clamp and the exhaust pipe, complete with exhaust tube.

### B. Installation

(1) Position the exhaust pipe, complete with exhaust tube, to the turbine case flange, making sure that the integral dowel pin correctly seats in the mating hole in the case flange.

(2) Install the halves of the exhaust pipe clamp and join together with the T-bolts. Screw up the high-temperature self-sealing nuts an equal distance on each T-bolt.

(3) Torque tighten each nut to the value etched on the clamp flange, that is, 45 lbf/in.

(4) Tap the circumference of the flange halves of the clamp with a non-metallic mallet.

(5) Re-torque each nut to the value etched on the clamp flange.

(6) Repeat paragraphs (4) and (5).

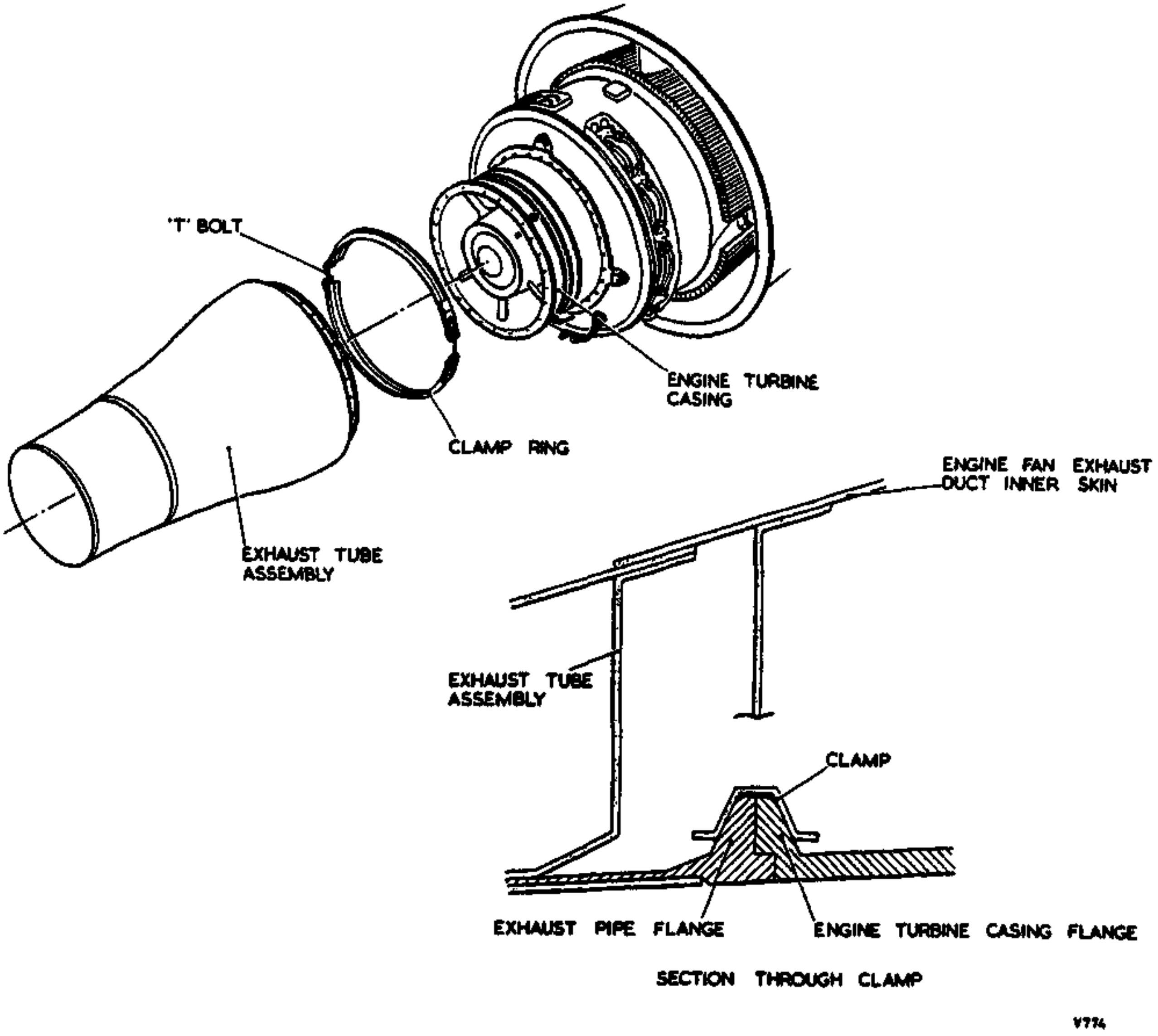
(7) Install the engine fan exhaust duct inner skin panels (paragraph 5.B.).

(8) Install the engine rear mount fairing (paragraph 4.B.).

(9) Install the aft cowl assembly (paragraph 3.B.).

(10) Install the upper panel (paragraph 2.B.).

(11) Install the lower access door (paragraph 1.B.).



Exhaust tube assembly attachment
*Figure 407*

## 7. Inlet cowl *(Figure 408)*

### A. Removal

*NOTE: Note the position of pipe clips, clamps, brackets etc., before removal.*

(1) Remove the lower access door (paragraph 1.A.).

(2) Remove the upper panel (paragraph 2.A.).

(3) Release the worm-drive clip securing the flexible cooling duct to the starter/generator.

(4) Disconnect the electrical connector from the inlet cowl anti-icing valve solenoid.

(5) Remove the V-clamp from the duct joint at the inlet side of the inlet cowl anti-icing valve (Chapter 75, AIR).

(6) Disconnect the engine electrical harness plugs from the inlet cowl anti-icing system pressure switches (*Figure 408, Sheet 2).*

(7) Unclip the pressure switches harness leads from the inlet cowl flange.

(8) Unclip the engine PT2 pipe from the inlet cowl/engine flange angles.

(9) Disconnect the PT2 pipe from the engine sensor unit and at the pylon interface connection. Remove the PT2 pipe.

(10) Left inlet cowl *(Figure 408 Sheet 1).*

  (a) Disconnect the hydraulic supply, pressure and drain, pipes and hoses from the bracket-mounted unions on the inlet cowl. Seal off the open ends of the pipes and hoses.

  (b) Free the hydraulic pipes from the fairlead clamping the pipes to the bottom of the inlet cowl.

  (c) Disconnect and remove the hydraulic pipes from the hydraulic pump. Seal off pipe ends and pump connections.

  (d) Disconnect the fuel hose and pipe from the union on the inlet cowl bracket. Seal off the pipe and hose.

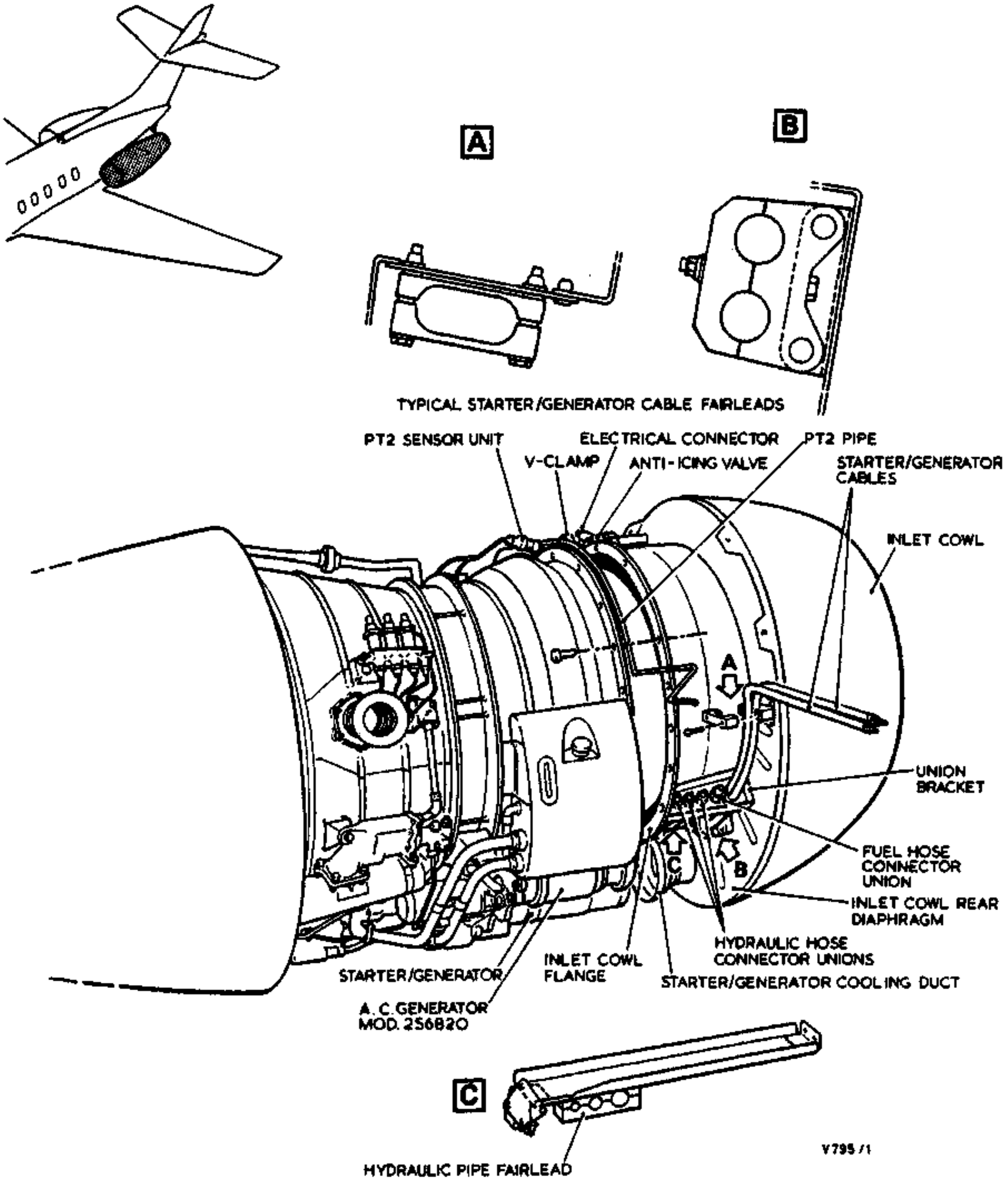
  (e) Unclip the fuel pipe from the inlet cowl just above the starter generator.

  (f) Disconnect and remove fuel pipe from engine fuel control unit. Seal off the pipe and the fuel control unit apertures.

  (g) Mod.256820 and 256821 - Unclip the a.c. generator cables from the starter/generator cable fairleads and disconnect the cable from the a.c. generator (Chapter 24, ELECTRICAL POWER - GENERAL).

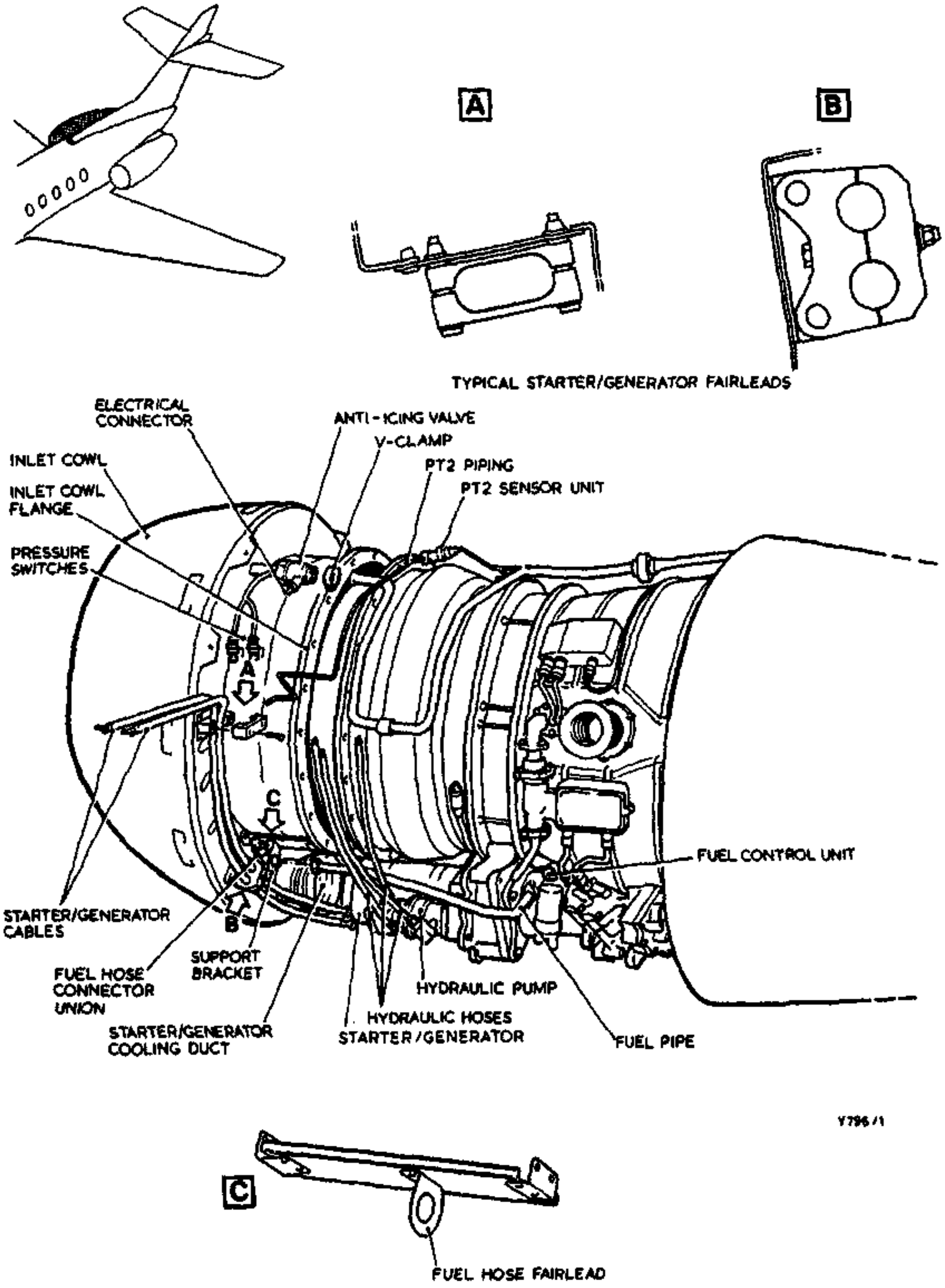
(11) Remove the nuts, bolts and washers, from the fairleads clamping the starter/generator cables to the inlet cowl rear diaphragm.

(12) Disconnect the starter generator cables from the starter/generator (Chapter 24, ELECTRICAL POWER - GENERAL).



Inlet cowl removal - Left

*Figure 408 (Sheet 1 of 2)*



Inlet cowl removal - right

*Figure 408 (Sheet 2 of 2)*

(13) Right inlet cowl *(Figure 408 Sheet 2)*.

  (a) Unclip the a.c. generator cable from the starter/generator cable fairleads, and disconnect the cables from the a.c. generator (Chapter 24, ELECTRICAL POWER - GENERAL).

  (b) Disconnect the hydraulic supply, pressure and drain hoses at the pylon interconnection. Seal off the open ends of the hoses.

  (c) Disconnect the fuel hose from the fuel pipe connector union on the engine. Install cap to the hose.

  (d) Release the fuel pipe from the support bracket attached to the inlet cowl.

  (e) Disconnect the fuel pipe from the engine fuel control unit.

    (i) Remove the nuts securing the fuel pipe, adapter end, to the fuel control unit.

    (ii) Withdraw the pipe adapter end from the fuel control unit.

    (iii) Remove the pipe from the engine and discard the adapter O-ring.

    (iv) Seal off the fuel control unit and fuel pipe apertures.

(14) Remove the inlet cowl from the engine fan casing.

  (a) Note the position of the brackets and cable clips on the inlet cowl/engine attachment flange.

  (b) Take out the bolts securing the fire detection wire bracket(s) to the engine casing flange.

  (c) Remove the nuts and bolts from the PT2 pipe clip angles.

  (d) Support, that is, tie-up the engine oil tank.

  (e) Remove the bolts and washers securing the oil tank mounting brackets to the fan casing.

  (f) Remove all nuts, bolts and washers from the inlet cowl/engine fan casing attachment flange *(Figure 409)*.

  (g) Remove the inlet cowl.

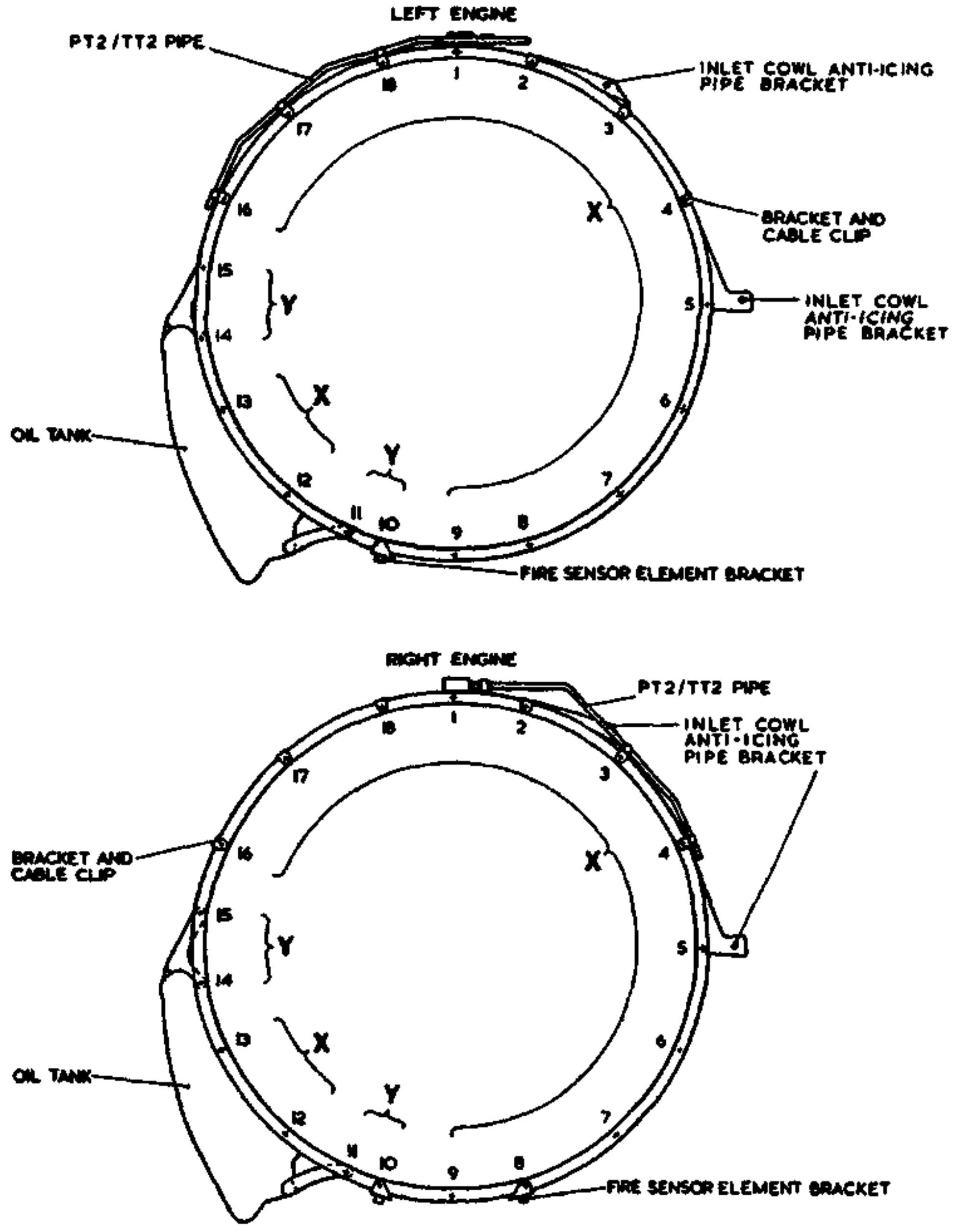
**B. Installation** *(Figure 408 and Figure 409)*

(1) Position the inlet cowl to the engine fan casing flange and locate with the top center (hole 1) bolt and washer.

(2) Install wire-locking bolts and washers to pick-up the engine oil tank brackets. Tighten bolts and wire-lock. Release the oil tank supporting media.

(3) Install the PT2 pipe clip angles with bolts and nuts at the positions indicated in *Figure 409*. Tighten attachments.

(4) Install the fire protection wire brackets using existing bolts and tighten.


LEFT ENGINE
PT2/TT2 PIPE
INLET COWL ANTI-ICING PIPE BRACKET
BRACKET AND CABLE CLIP
INLET COWL ANTI-ICING PIPE BRACKET
OIL TANK
FIRE SENSOR ELEMENT BRACKET
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
X
Y
RIGHT ENGINE
PT2/TT2 PIPE
INLET COWL ANTI-ICING PIPE BRACKET
BRACKET AND CABLE CLIP
OIL TANK
FIRE SENSOR ELEMENT BRACKET

ATTACHMENT LOCATIONS (LOOKING AFT)

| HOLE REFERENCE No. | ATTACHMENT |
|---|---|
| X 1 TO 9, 12 & 13, 16 TO 18 | BOLT 10/32 UNF<br>(STANDARD) |
| Y 10 & 11 14 & 15 | BOLT 10/32 UNF<br>(HEAD DRILLED FOR WIRE LOCKING)<br>NUT 10/32<br>WASHER 10/32 |

V765/2

Inlet cowl attachment locations

*Figure 409*

(5) Install the remainder of the bolt, nut and bolt, attachments at the inlet cowl engine fan duct casing *(Figure 406)* and torque load at 30 to 35 lbf/in.

(6) Engine connections - Pre-Mod.252779.

(a) Before connecting the starter/generator heavy duty cables, make sure that the cable protrusion from the fairlead *(Figure 410 - left or Figure 411 - right)* at pylon interface is:

Left engine
+ve cable = 3ft 2.0 in.    from pylon fairlead to center of cable lug eye-end, measured
-ve cable = 3ft 2.25 in.    in a straight line.

Right engine
+ve cable = 2ft 6.5 in.    from pylon fairlead to center of cable lug eye-end, measured
-ve cable = 2ft 7.0 in.    in a straight line.

*NOTE: If the cable protrusion is correct, proceed as in paragraph (8) If the protrusion is not correct, embody Mod.252779 (new shorter cables incorporating shrunk-on locating sleeves to define correct protrusion.*

(b) Route and clamp/clip up starter/generator and a.c. generator cables.

(c) Connect output socket to a.c. generator and locally clip cables.

(7) Engine connections - Mod.252779.

(a) Before connecting the starter/generator heavy duty cables, make sure that the cable locating sleeves abut the pylon fairlead.

(b) Do paragraphs (6) (b) and (c).

(8) Connect starter/generator light and heavy duty cables.

(a) Attach heavy duty cables to terminal block, install washers and nuts.

(b) Torque tighten nuts to 100 lbf/in.

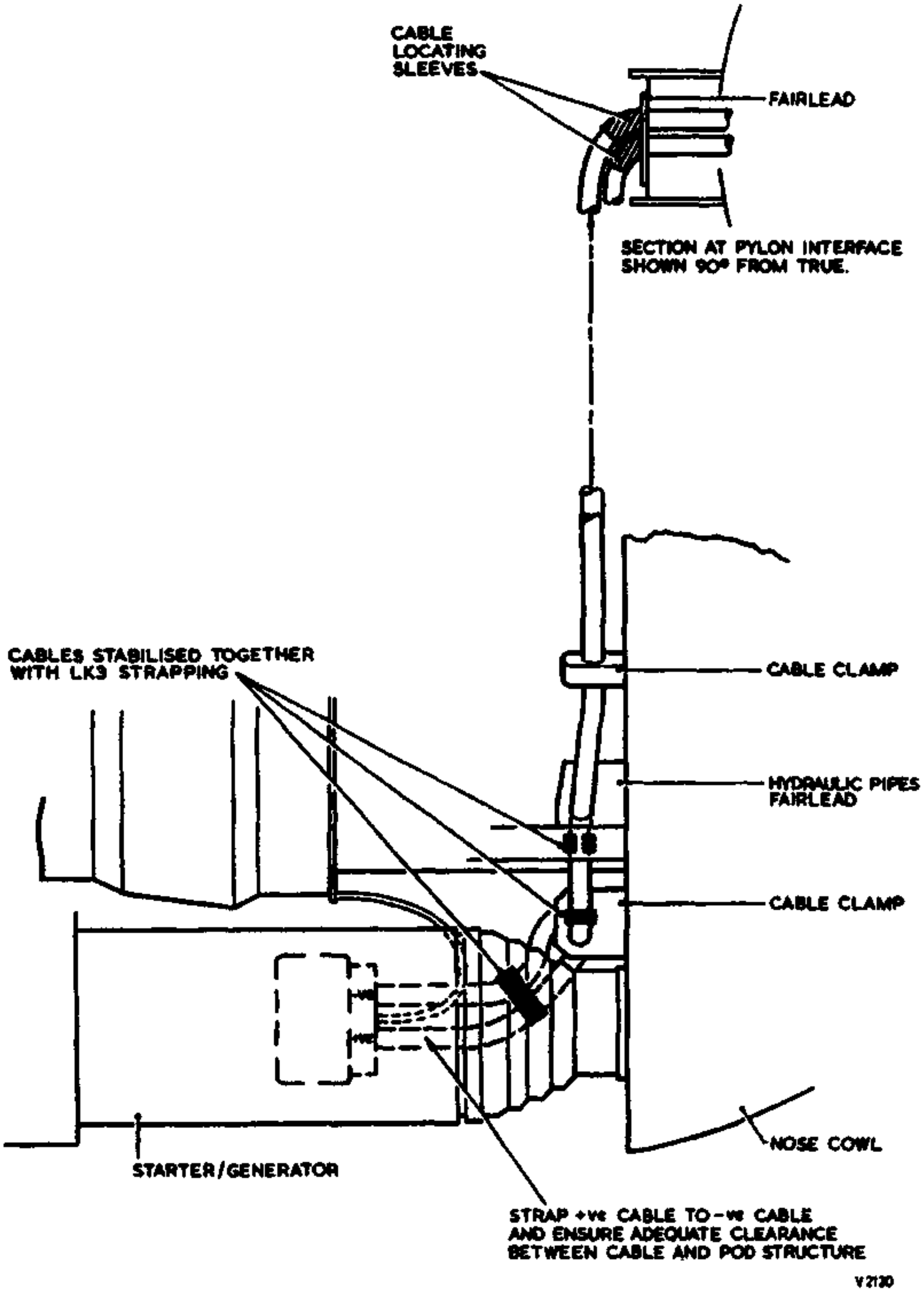
(c) Roll cable rubber boot to cover terminal block.

(d) Connect light duty cables.

(e) Connect speed sensor cable connector to socket on starter/generator.

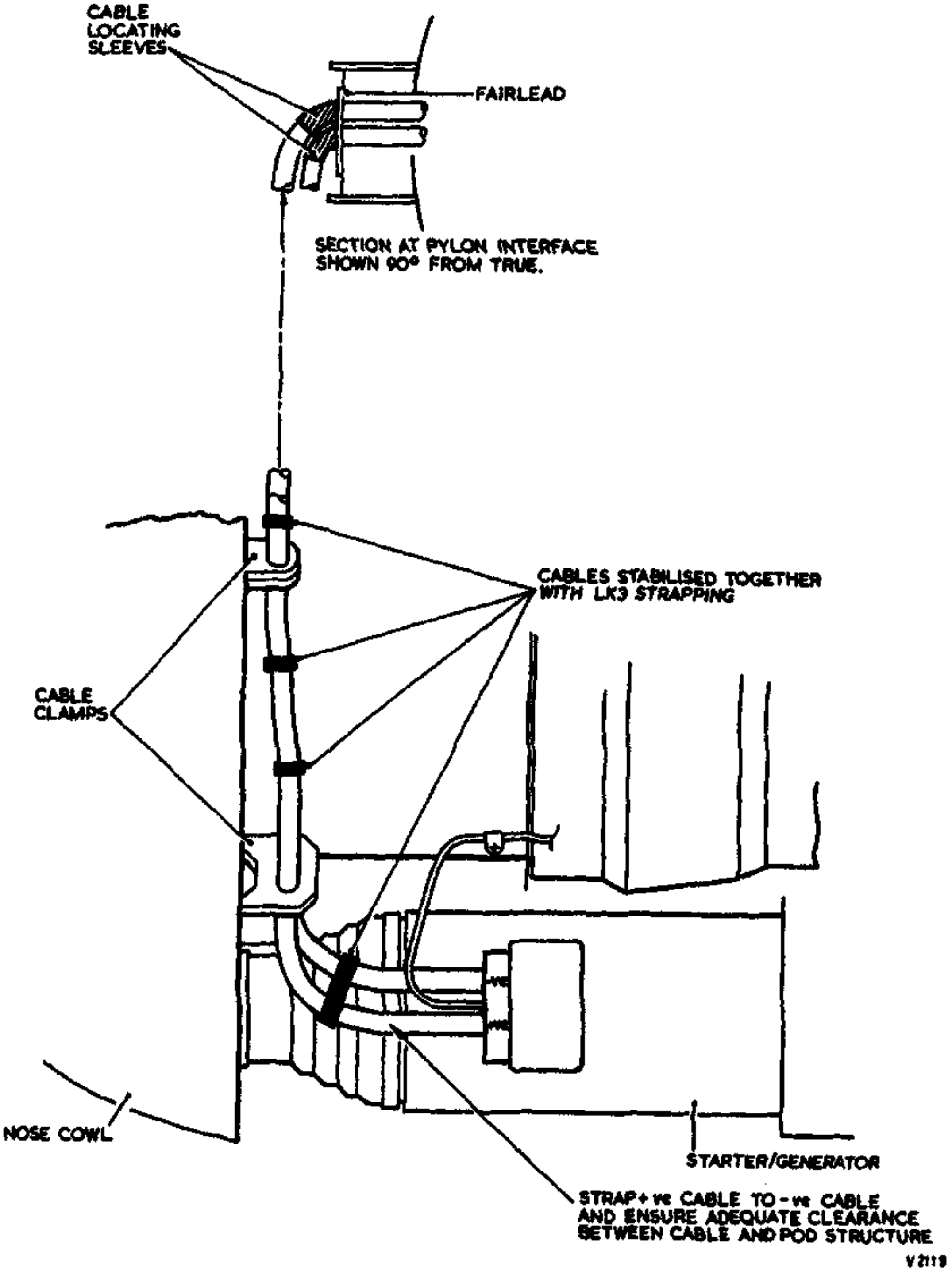
(f) Aircraft Pre-Mod.252779 - Install TY9 cable strappings at the positions previously vacated.

(g) Aircraft with Mod.252779 - Install LK3 cable strappings at the positions shown in *Figure 410 (left engine) or 411 (right engine).*


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMP
HYDRAULIC PIPES FAIRLEAD
CABLE CLAMP
NOSE COWL
STARTER/GENERATOR
STRAP +ve CABLE TO -ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2130

Location of starter/generator heavy duty cables - Mod.252779 - left engine

*Figure 410*


CABLE LOCATING SLEEVES
FAIRLEAD
SECTION AT PYLON INTERFACE SHOWN 90° FROM TRUE.
CABLES STABILISED TOGETHER WITH LK3 STRAPPING
CABLE CLAMPS
+ve
-ve
NOSE COWL
STARTER/GENERATOR
STRAP+ve CABLE TO -ve CABLE AND ENSURE ADEQUATE CLEARANCE BETWEEN CABLE AND POD STRUCTURE
V2119

Location of starter/generator heavy duty cables - Mod.252779 - right engine

*Figure 411*

(9) Remove the caps and connect the fuel pipe to the engine fuel control unit and cowl bracket.

- (a) Install a new O-ring in pipe adapter end.
- (b) Insert adapter end into the fuel control unit.
- (c) Install the attachment nuts and torque tighten to 50-55 lbf/in.
- (d) Connect the fuel pipe to the cowl.
    - (i) Right cowl only: connect the pipe to the elbow fitting.
    - (ii) Left cowl only: connect the pipe to the fuel hose connector elbow union on the cowl bracket. Clip pipe to the cowl bracket just above the starter generator.
- (e) Wire-lock the connections.

(10) Remove the cap and install the fuel hose.

- (a) Right cowl only: Connect the hose to the elbow connector union fitting on the cowl.
- (b) Left cowl only: Connect the hose to the pipe union on the cowl bracket.
- (c) Wire-lock.

(11) Install the hydraulic pressure, suction and case drain, pipes and hoses.

- (a) Left cowl only:
    - (i) Remove the caps and install the hydraulic pipes between the hydraulic pump and pipe unions mounted on the inlet cowl.
    - (ii) Clamp the hydraulic pipes in the pipe clamp at the bottom of the cowl.
    - (iii) Connect the hydraulic pressure, suction and case drain hoses, still attached to the pylon, to the pipe unions mounted on the cowl.
- (b) Right cowl only: Connect the hydraulic hoses to their pylon connect points.

(12) Wire-lock all hydraulic connections.

(13) Connect the PT2 pipe to the engine sensor unit and pylon interface union. Wire-lock the connections.

(14) Clip the PT2 pipe to the inlet cowl/engine flange angles.

(15) Clip the inlet cowl anti-icing pressure switches engine electrical harness leads to the inlet cowl/engine flange.

(16) Connect the engine electrical harness plugs to the inlet cowl anti-icing pressure switches.

(17) Connect the inlet side of the nose inlet cowl anti-icing valve to the supply duct (Chapter 75, AIR).

(18) Connect the engine electrical harness plug to the inlet cowl anti-icing valve solenoid, wire-lock.

(19) Manoeuvre the starter/generator air cooling flexible duct onto the starter/generator and tighten the worm drive clip.

(20) Install the upper panel (paragraph 2.B.).

(21) Install the lower access door (paragraph 1.B.).

# COWLINGS
# ADJUSTMENT/TEST

## 1. Pressure relief doors - Pre-load check *(Figure 501)*

### A. Procedure

(1) Attach a spring balance to the pressure relief door at the door lip on the latch center-line.

(2) Make sure that a pulling load of 10 lb ± 2 lb. (4.54 ± 1 kg) applied to the edge of the door, normal to the profile, opens the door.

(3) Close the door, and make sure that the latch plunger is engaged and spring-loaded into the latch block, i.e. the door is securely closed and has no chattering movement.

(4) If free movement is present, unscrew adjuster nut slightly and recheck (1), (2) and (3).

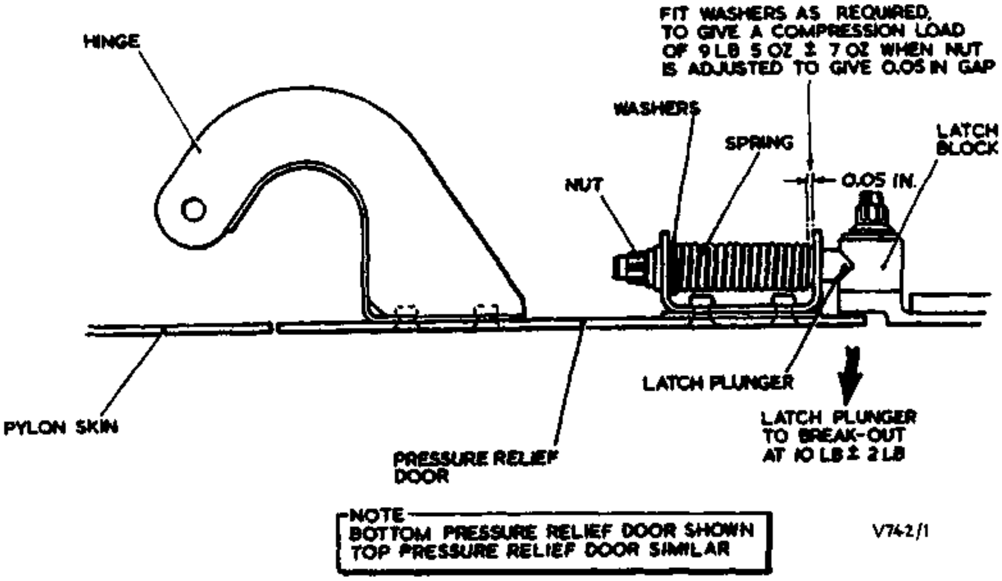
(5) Repeat paragraph (4) until correct.

## 2. Pressure relief doors - Pre-load adjustment *(Figure 501)*

| Equipment/Material | Part/Item No. |
|---|---|
| Washers, shim | SP.126D As required |
| Grease | Item 078 (Chapter 20-95-11) |

### A. Procedure

(1) Open the pylon skin pressure relief door.


FIT WASHERS AS REQUIRED, TO GIVE A COMPRESSION LOAD OF 9 LB 5 OZ ± 7 OZ WHEN NUT IS ADJUSTED TO GIVE 0.05 IN GAP
HINGE
WASHERS
SPRING
LATCH BLOCK
NUT
0.05 IN.
LATCH PLUNGER
LATCH PLUNGER TO BREAK-OUT AT 10 LB ± 2 LB
PYLON SKIN
PRESSURE RELIEF DOOR
NOTE
BOTTOM PRESSURE RELIEF DOOR SHOWN
TOP PRESSURE RELIEF DOOR SIMILAR
V742/1

Pylon pressure relief door loading details
*Figure 501*

(2) Install shim washers, as required, between the latch spring and the latch bracket to give a compression load to the latch plunger of 9 lb 5 oz. ± 7 oz. (4.223 ± 0.198 kg) when the latch nut is adjusted to give a 0.05 in. (0.127 mm) gap between the opposite end of the spring and latch bracket, as shown on *Figure 501.*

(3) Lubricate the spring and latch plunger on reassembly with specified grease.

(4) Close and latch the door.

(5) Test the door for load to unlatch the door as described in paragraph 1. - Pre-load check.

## 3. Adjust lower access door latches *(Figure 502)*

### A. Procedure

(1) Unlatch and open the door. Stay in the open position.

(2) Adjust each inboard latch in turn, and as many times as is necessary, to obtain maximum clamp-up on all latches simultaneously, by trial and error, as follows:

  (a) Remove the screw from the inboard latch post sleeve.

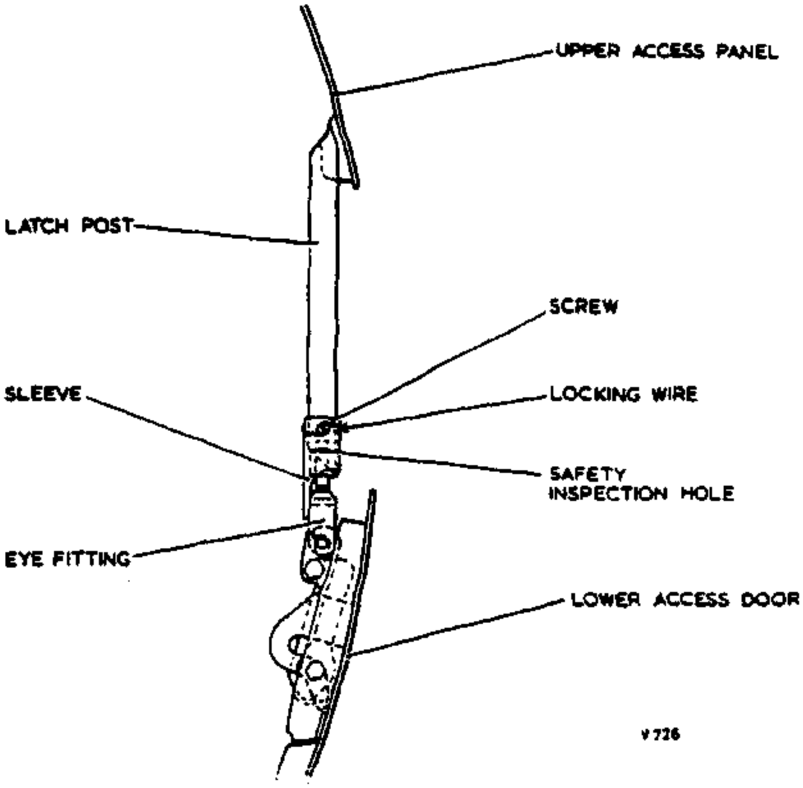
  (b) Slide the sleeve up the post clear of the eye-fitting.

  (c) Screw eye-fitting in or out, as necessary, to obtain maximum clamp-up, that is, no interwind edges, by hand operation of the latch.

(3) Make sure that the eye-fitting threads are in safety by the hole in the post.

(4) Reposition the sleeve and re-install the screw. Wire-lock the screw.

Figure 502 on following page



Lower access door latch adjustments
*Figure 502*

# ENGINE MOUNTS
# DESCRIPTION

## 1. General *(Figure 1)*

The engine/nacelle assembly is supported from the engine pylon by two (front and rear) mounting assemblies which attach to the side of the engine. Engine thrust is applied to the airframe through the front (main) mount. The rear mount takes only vertical and lateral loads, and merely supports and aligns the rear of the engine. Spherical bearings are embodied in both the front and rear mounting assemblies.

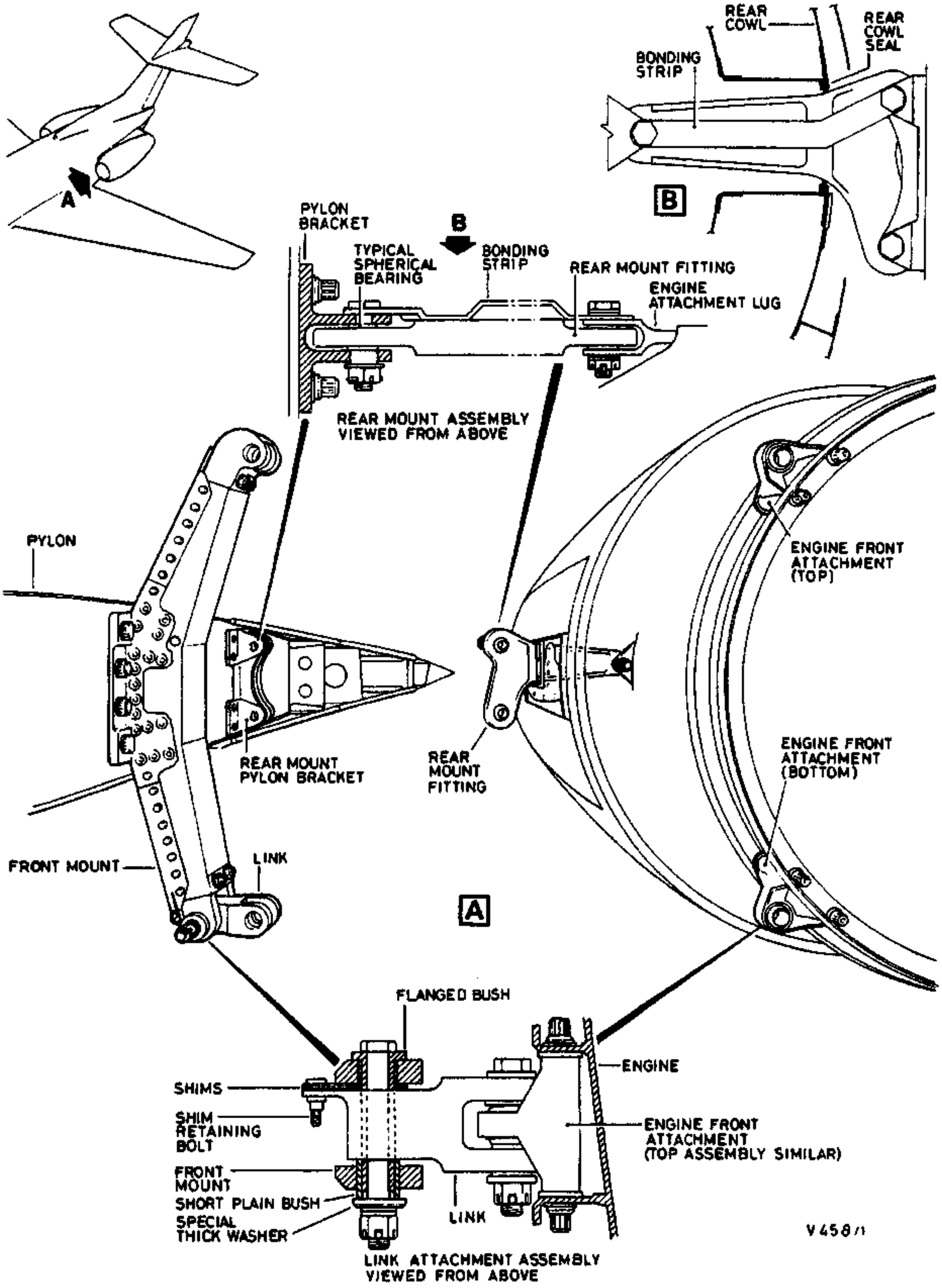
## 2. Main (front) Mount

The front mount picks up the engine at points above and below the engine longitudinal datum. The top lug is secured to the engine attachment direct while the bottom lug connects the engine through a link. The mount is a fabricated box section, constructed of titanium forgings assembled with high strength bolts. The assembly is bolted to the pylon to become a semi-permanent fixture. All lug joints are stainless steel bushed.

The link is a one-piece titanium forging which connects the yoke to the engine bottom attachment and provides flexibility to accommodate engine growth. Stainless steel shims are used between the link and the yoke lower lug to cater for manufacturing tolerances of the engine, the mount and the pylon fitting. The shims are bolted to the link to prevent their loss when the engine is removed.

## 3. Rear Mount

The rear mount is a one-piece titanium fitting, having three attachment lugs each installed with self-aligning stainless steel bearings. The mount engages with a fork on the engine with one lug and a bracket on the pylon with two lugs. All three attachments are secured with close tolerance stainless steel bolts. The rear mount is installed to the engine prior to its installation with the final connection being made to the pylon bracket. A bonding strip bonds the engine to the airframe structure, via the rear mount.



Engine mounts

*Figure 1*

# ENGINE MOUNT (FRONT) - REMOVAL/INSTALLATION

## 1. Removal *(Figure 401)*

**CAUTION: KEEP A LIST OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONNEL WHO DO WORK ON, OR WORK NEAR THE ENGINES.**

**CAUTION: WHEN A PIPE OR OTHER COMPONENT IS REMOVED, IMMEDIATELY INSTALL A COVER ON THE OPENING.**

| Equipment/Materials | Part/Item No. |
|---|---|
| Torque wrench (0 - 1000 lbf.in) | Local supply |
| Engine oil | Item 137 (Chapter 20-95-101) |
| Wire, corrosion resistant | Item 651 (Chapter 20-95-601) |
| Grease | Item 054 (Chapter 20- 95-11) |

### A. Procedure

*NOTE: The procedure for removal/installation of the engine front mount assembly is the same for both left and right engines (Figure 401).*

(1) Remove the engine (Chapter 71-00-00 POWER PLANT (ENGINE CHANGE) - REMOVAL/ INSTALLATION).

(2) Remove and discard the lockwire from the bolt heads and castellated nuts.

(3) Remove and discard the split pins from the four castellated nuts.

(4) Remove the four castellated nuts and the four packing washers from the bolts. Remove the four attachment bolts.

*NOTE: Make sure that the front mount assembly is supported, before the remaining four outer attachment bolts are removed.*

(5) Carefully remove the remaining four bolts and the four packing washers that attach the front mount assembly to the engine mounting bracket.

(6) Carefully remove the the front mount assembly from the engine mounting bracket.

(7) Examine all removed components for damage, wear or distortion and replace as necessary.

## 2. Installation *(Figure 401)*

### A. Procedure

(1) Make sure that all components to be installed are clean and are not damaged.

(2) Lubricate the bolt shank, thread and underside of the head of the four outer attachment bolts with engine oil (Item 137).

(3) Apply a coating of grease (Item 054) to the mateing surface of the front mount assembly.

(4) Put the front mount assembly to the engine mounting bracket, make sure that the link is at the bottom.

(5) Install the lubricated outer bolts and the packing washers through the front mount assembly into the nut plates of the engine mounting bracket. Lightly tighten the bolts

*NOTE: Do not torque tighten the bolts at this step.*

(6) Install the four inner bolts through the engine mounting bracket. Install the packing washers and the castellated nuts on the bolts. Lightly tighten the nuts.

(7) Torque tighten the lubricated outer bolts to between 1200 to 1250 lbf/in (135,60 to 141,24 Nm).

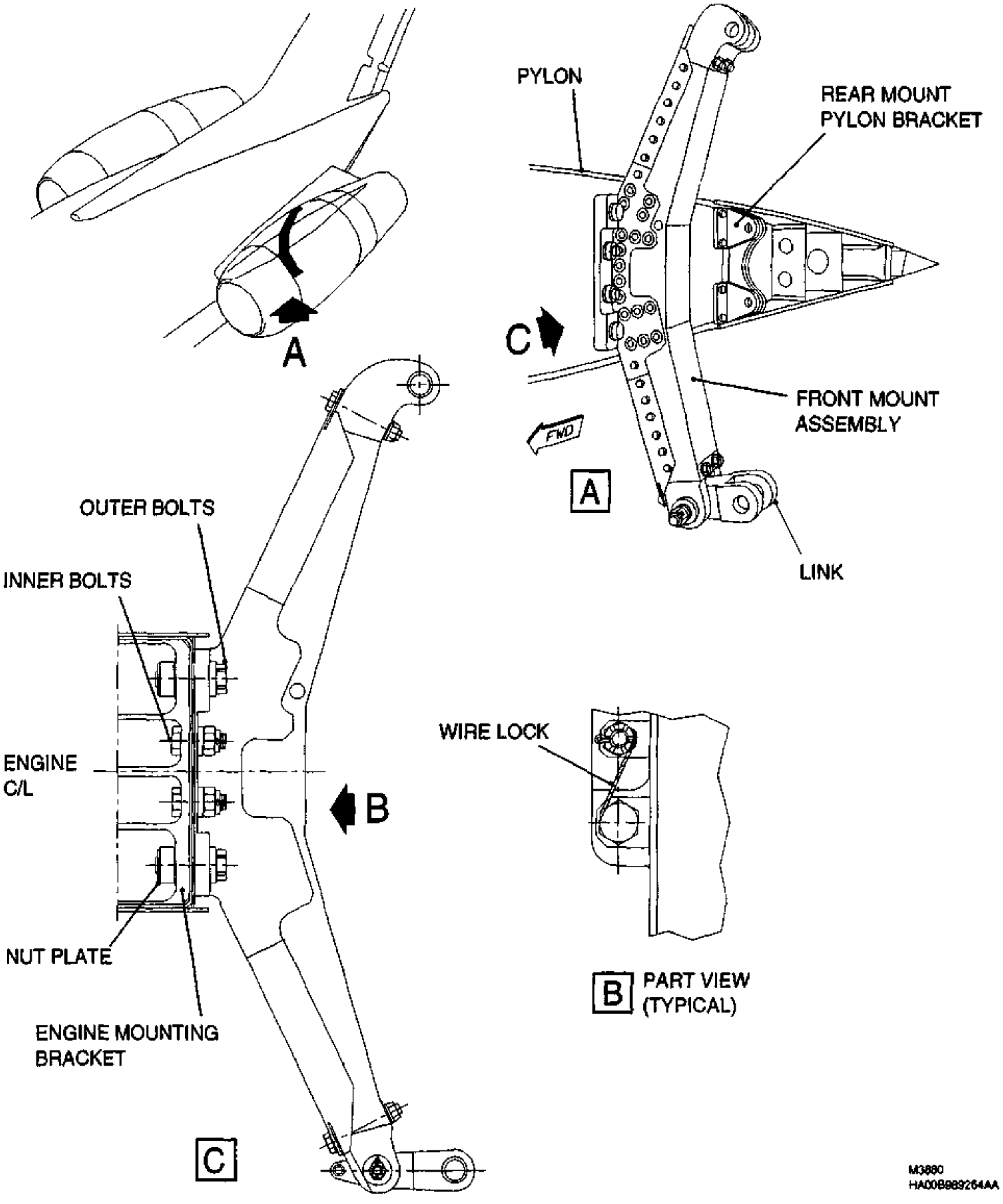
(8) Torque tighten the inner castellated nuts to between 225 to 250 lbf/in (25,42 to 28,24 Nm) to give access for the split pins.

(9) Remove any excess grease (Item 054) that has been expelled from around edges of the front mount.

(10) Install the split pins and lock them in position.

(11) Check torque tighten the lubricated outer attachment bolts.

(12) Wire lock the the outer attachment bolts to the castellated nuts as shown.



Engine front mount assembly - removal/instalation
*Figure 401*

# POWER PLANT DRAINS
# DESCRIPTION

## 1. General *(Figure 1)*

Witness drains are provided in the cowling lower access door to give visual indication of an oil and fuel seal leakage. The witness drains are provided as part of the Power plant and comprise the following:

(1) Fuel control drain (Flow divider and drain valve)
(2) Fuel pump drain
(3) Gear box breather vent
(4) Hydraulic pump drain
(5) Starter generator drain
(6) Alternator (a.c. generator) drain
(7) Combustion chamber drain valves.

## 2. Engine and accessory witness drains

Engine and accessory witness drains are provided by individual pipes installed to the engine drain points and routed to a common drain scupper at the bottom of the cowling lower access door. At the scupper, the drain pipes are clamped together and exhaust through a drain mast projecting from the lower access door. Opening this door exposes the pipes and joints.

## 3. Gear box breather vent

The gear box breather is vented independently via a stub pipe on the lower part of the engine and a mating stack pipe on the lower access door.

## 4. Fuel control drain

The fuel control flow divider and drain, drains fuel from the primary nozzles during engine shutdown. On each normal engine shutdown, a very small amount of fuel will emerge from the drain and drain mast.

## 5. Combustion chamber drain valves

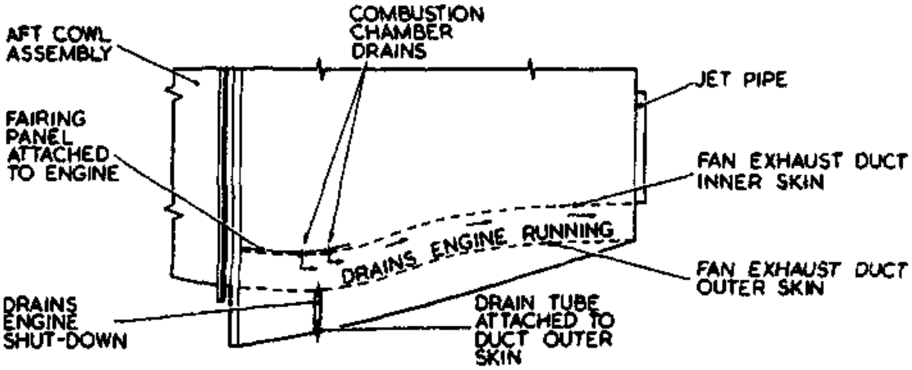
Two drain valves dispose of fuel accumulated during false starts and engine shutdown. The valves are spring-loaded 'open' and are closed by rising pressure within the combustion chamber as the engine starts. These valves protrude through holes in a small panel in the fan duct inner skin which is attached to the engine. Fuel residue from a false start is ejected from the fan duct into the jet efflux as engine speed rises during a subsequent start. Fuel residue at engine shutdown passes through a drain tube attached to the fan duct outer skin and protruding through a hole in the engine aft cowling skin.

## 6. Breather vent valve

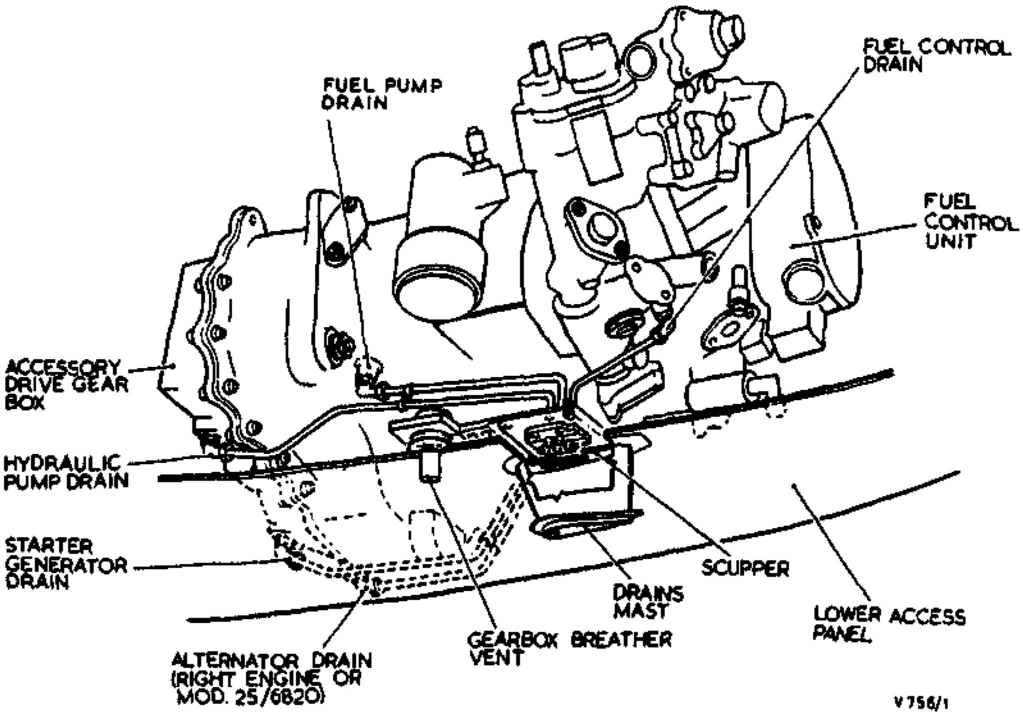
The breather vent on the engine incorporates a breather vent pressurizing valve which provides an ambient vent for the engine oil system at low altitudes and increases the internal engine vent and oil tank pressure at high altitudes to make sure of satisfactory oil pump operation.

## 7. Gear box drain

A plug is provided to enable the gear box oil to be drained into a suitable receptacle when the cowling lower access door is open.


AFT COWL ASSEMBLY
COMBUSTION CHAMBER DRAINS
JET PIPE
FAIRING PANEL ATTACHED TO ENGINE
FAN EXHAUST DUCT INNER SKIN
DRAINS ENGINE RUNNING
FAN EXHAUST DUCT OUTER SKIN
DRAINS ENGINE SHUT-DOWN
DRAIN TUBE ATTACHED TO DUCT OUTER SKIN

COMBUSTION CHAMBER DRAIN



ENGINE DRAINS

Power plant drains

*Figure 1*

# POWER PLANT DRAINS REMOVAL/INSTALLATION

## 1. Drains *(Figure 401)*

| Equipment/Material | Part/Item No. |
|---|---|
| Torque wrench, 25-30 lbf/in. | – |

### A. Remove drains assembly complete

(1) Open the lower access door.

(2) Unscrew the pipe nuts at the drain elbows from:

- (a) Fuel control drain.
- (b) Fuel pump drain.
- (c) Hydraulic pump - accessory gear box.
- (d) Starter/generator - accessory gear box.
- (e) Alternator - accessory gear box.

(3) Remove the stiffnut, washer and bolt, and release the starter/generator and fuel flowmeter cable clip from the mounting plate assembly.

(4) Remove the nut securing the mounting plate assembly to the forward end of the oil pipe.

(5) Remove the nuts and bolts pinching the clamp block to the gear box breather vent.

(6) Separate the clamp segments and remove the drain pipes, complete with the attached mounting plate assembly.

(7) Remove the O-ring from each drain pipe and discard.

(8) Release the locknut and unscrew the special elbow at each drain point.

(9) Seal off each drain aperture with plug and O-ring.

### B. Install drains assembly complete

(1) Remove the plugs and O-rings from the drain points.

(2) Screw the special elbows into the drain points.

(3) Loosely install the clamp block to the gearbox breather vent.

(4) Locate the mounting plate assembly on the engine oil pipe forward end attachment and secure with the nut. Torque tighten nut to 25-30 lbf/in.

(5) Install new O-ring on each drain pipe coupling nut.

(6) Line up the special elbows with the drain pipes and screw up each drain pipe nut.

(7) Tighten up the elbow locknuts.

(8) Tighten nuts and bolts on gearbox breather vent clamp.

(9) Wire-lock all pipe connections.

(10) Secure the starter/generator and fuel flowmeter cables to the clamp block mounting assembly with clip, bolt, washer and stiffnut.

### C. Remove individual drain pipes

(1) Unscrew drain pipe nut from drain point special elbow.

(2) Remove the nuts and bolts pinching the fairlead matched segment set together.

(3) Remove the fairlead, middle segment.

(4) Remove the pipe clip nut and bolt and unclip the pipe, if necessary.

(5) Remove the drain pipe from the fairlead and discard the O-ring.

(6) If necessary, remove the special elbow from the drain point and install plug and O-ring to the drain aperture.

### D. Install individual drain pipes

(1) If necessary, remove the drain point plug and install the special elbow. Tighten up the elbow locknut.

(2) Install new O-ring in drain pipe coupling nut and locate the drain pipe in the fairlead.

(3) Do an alignment check of the drain pipe with special elbow and fairlead.

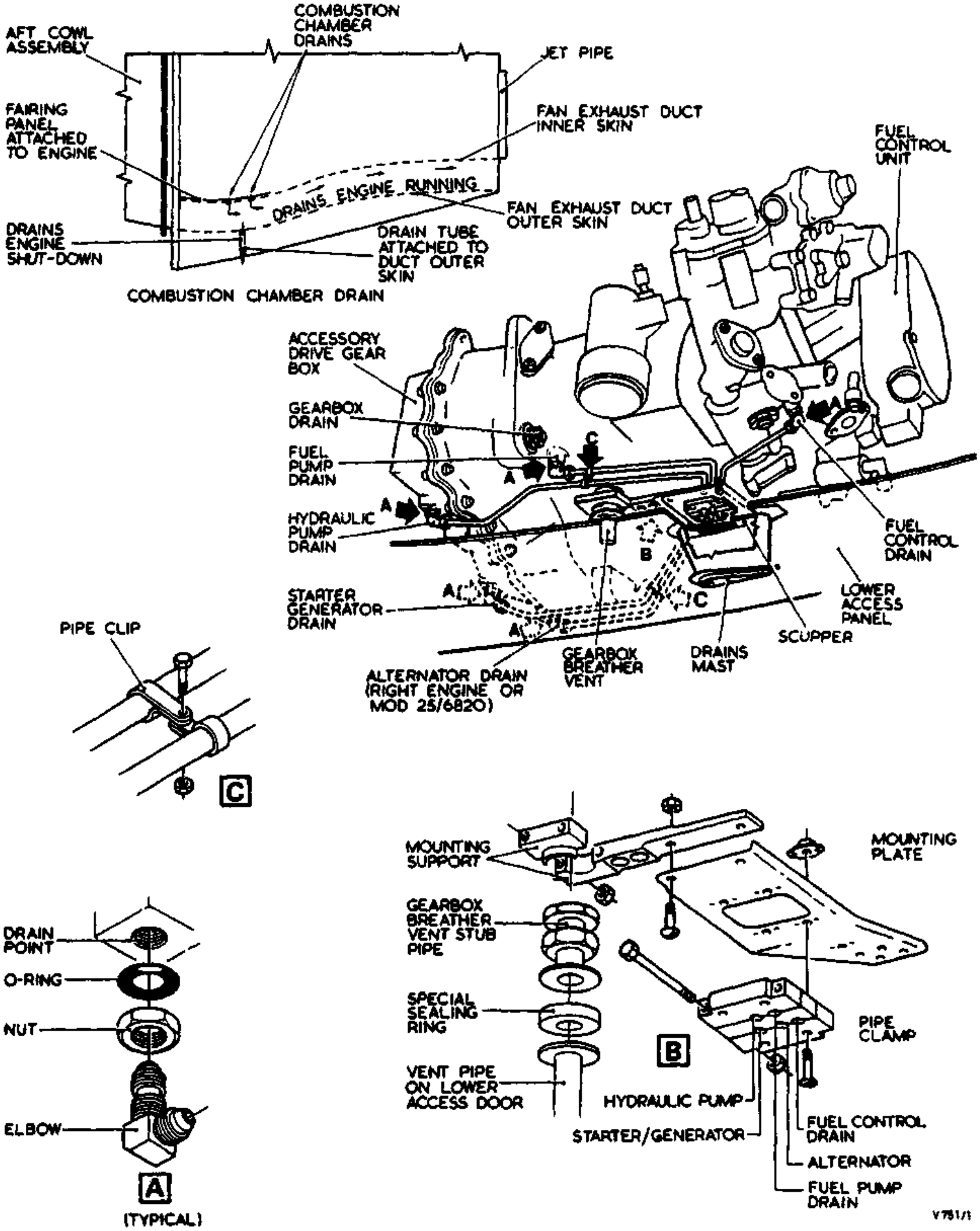
(4) Connect up the pipe to the special elbow and wire-lock.

(5) Install the fairlead middle segment and clamp the fairlead segments together with the nuts and bolts.

(6) Install pipe clip and secure with nut and bolt if necessary.

### E. Gearbox breather vent tube O-ring removal/installation

(1) Remove and renew the gearbox breather vent tube special sealing ring as and when necessary to maintain a serviceable seal with the lower access door.



Engine drains

*Figure 401*

# CHAPTER

# 72

# ENGINES

# CHAPTER 72

# ENGINE

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# ENGINE GENERAL
## SERVICING

### 1. Compressor liquid cleaning (compressor wash)

**A. Special tools, equipment and materials**

(1) Refer to Allied Signal, Light Maintenance Manual, Report No. 72-02-15, Chapter 72-00-00, SERVICING.

**B. General**

(1) Before doing the cleaning procedure, certain bleed orifices within the engine must be closed to minimise contamination of anti-ice, air conditioning and cabin pressurization supply systems.

**C. Preparation for compressor liquid cleaning**

(1) At the ICE PROTECTION section of the flight deck roof panel make sure that the appropriate ENG ANTICE ON-OFF switch is set at OFF.

(2) At the ENVIRONMENTAL section of the roof panel make sure that the appropriate MAIN AIR VALVES OPEN-CLOSE switch is set at CLOSE.

# ENGINE SUB-ASSEMBLIES AND COMPONENTS REMOVAL/INSTALLATION

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF, AN ENGINE. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER SUCH COMPONENT IS REMOVED, IMMEDIATELY INSTALL A BLANK TO THE APERTURE.**

*NOTE: The procedures required to gain access to the Allied Signal engine sub-assemblies and components, to permit their removal from an installed power plant are grouped into "common access procedural" groups. Reference is also made to the pertinent Removal/Installation procedure as detailed in the Allied Signal, Light Maintenance Manual Report No.72-02-15.*

## 1. Group 1 - Procedures

### A. Group 1 - sub-assemblies and components *(Refer to Allied Signal Light Maintenance Manual)*

| | | |
|---|---|---|
| (1) | Installation, engine/power section nameplate | Chapter 72-00-01. |
| (2) | Installation, engine wiring harness | Chapter 72-00-02. |
| (3) | Plug, borescope inspection | Chapter 72-30-03. |
| (4) | Combustion chamber drain valves and high pressure bleed cover | Chapter 72-40-01. |

### B. Group 1 - access procedure

(1) Remove lower access door.

(a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot and turn the lever outboard to release. Open access door.

(b) With the door suitably supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into each facia hole. Lever outboard to release. Remove access door.

(2) Remove upper panel.

(a) At the aft edge of the-panel, insert a suitable 0.25 in. diameter rod into the facia hole of each shear pin latch in turn. Lever outboard to release.

(b) At the forward edge of the panel, remove three countersunk bolts securing the panel to the inlet cowl. Carefully remove the panel making sure that its hinge bars (3) do not damage local electrical cables or looms.

### C. Group 1 - Close up

(1) Install upper panel.

(a) Locate the panel on the engine. Take care that its hinge bars do not damage local electrical cables or looms.

(b) Align bolt holes (3 off) at the forward edge of the panel and install securing bolts but do not tighten at this stage.

(c) Align the shear pins (2 off) with their assembly housings on the aft cowl. Close the shear pin latches and make sure they seat flush.

(d) Tighten the panel securing bolts installed in paragraph (b).

(2) Install lower access door.

(a) Position the door up to the hinge bars on the upper panel. Close the hinge latches and make sure they seat flush.

(b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (Chapter 71-10-00, SERVICING).*

## 2. Group 2 - Procedures *(Figures 401, 402, 403, 404, 405, 406, 407)*

### A. Group 2 - sub-assemblies and components *(Refer to Allied signal, Light Maintenance Manual)*

| | |
|---|---|
| (1) Nozzle thrust and exhaust | Chapter 72-50-02. |
| (2) Brackets installation mounting (N1 and ITT) | Chapter 72-50-03. |

### B. Group 2 - access procedure

*NOTE: Due to the complexity of the bolt-up arrangement at the engine rear mount fairing and the necessity for correct identity of bolts, nuts and washers during disassembly and assembly, it is recommended that an aide-memoire panel for storage of bolts etc. be locally manufactured.*

*NOTE: The panel can be made from thin metal or plywood using the layout given by Figure 404 Sheet 1 suitably enlarged. Drill the holes using a 4.9 mm diameter drill and stencil LH on the obverse face and RH on the reverse face.*

(1) Remove lower access door.

(a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot. Turn lever outboard to release. Open the access door.

(b) With the door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into the facia hole, lever outboard to release. Remove access door.

(2) Remove upper panel.

(a) At the aft edge of the panel, insert a suitable 0.25 in. diameter rod into the facia hole of each shear pin latch. Turn lever outboard to release.

(b) At the forward end of the panel, remove three countersunk bolts securing the panel to the inlet cowl. Carefully remove the upper panel making sure that its three hinge bars do not damage local electrical cables or looms.

(3) Isolate electrical power supplies by withdrawing pertinent fuses and/or opening circuit breakers (Table 401).

(4) Remove engine rear mount access panels from pylon top and bottom surfaces.

(5) Remove aft cowl assembly *(Figure 401)*.

(a) Remove aft cowl assembly top and bottom outer closing panels at the engine rear mount.

(b) Remove bolts etc., from the longitudinal edges of the upper panel/ lower panel assembly and aft cowl inner skin. Stow attachments in the aide-memoire panel.

(c) Remove bolts etc. connecting the rear angle to the aft cowl inner skin. Stow bolts in the aide memoire panel.

*NOTE: The upper panel and lower panel assembly are left connected to the attachment flange on the engine at this stage.*

(d) Disconnect electrical leads and pipes from their P-clips on the aft cowl forward diaphragm.

(e) Support aft cowl assembly then remove nuts, washers and bolts from aft cowl/engine fan duct flange (except at attachment locations 10-19 (left engine) or 37-46 (right engine).

(f) Withdraw aft cowl assembly rearwards.

(6) Remove fan exhaust duct inner top and bottom skin panels *(Figure 402)*.

(a) Remove screws and washers securing high pressure air bleed pipe front fairing to top panel and remove fairing.

(b) Remove screws and washers from top panel forward periphery and longitudinal lap joints and remove top panel.

(c) Support bottom panel, remove screws and washers at forward periphery and remove bottom panel.

(7) Remove exhaust tube assembly.

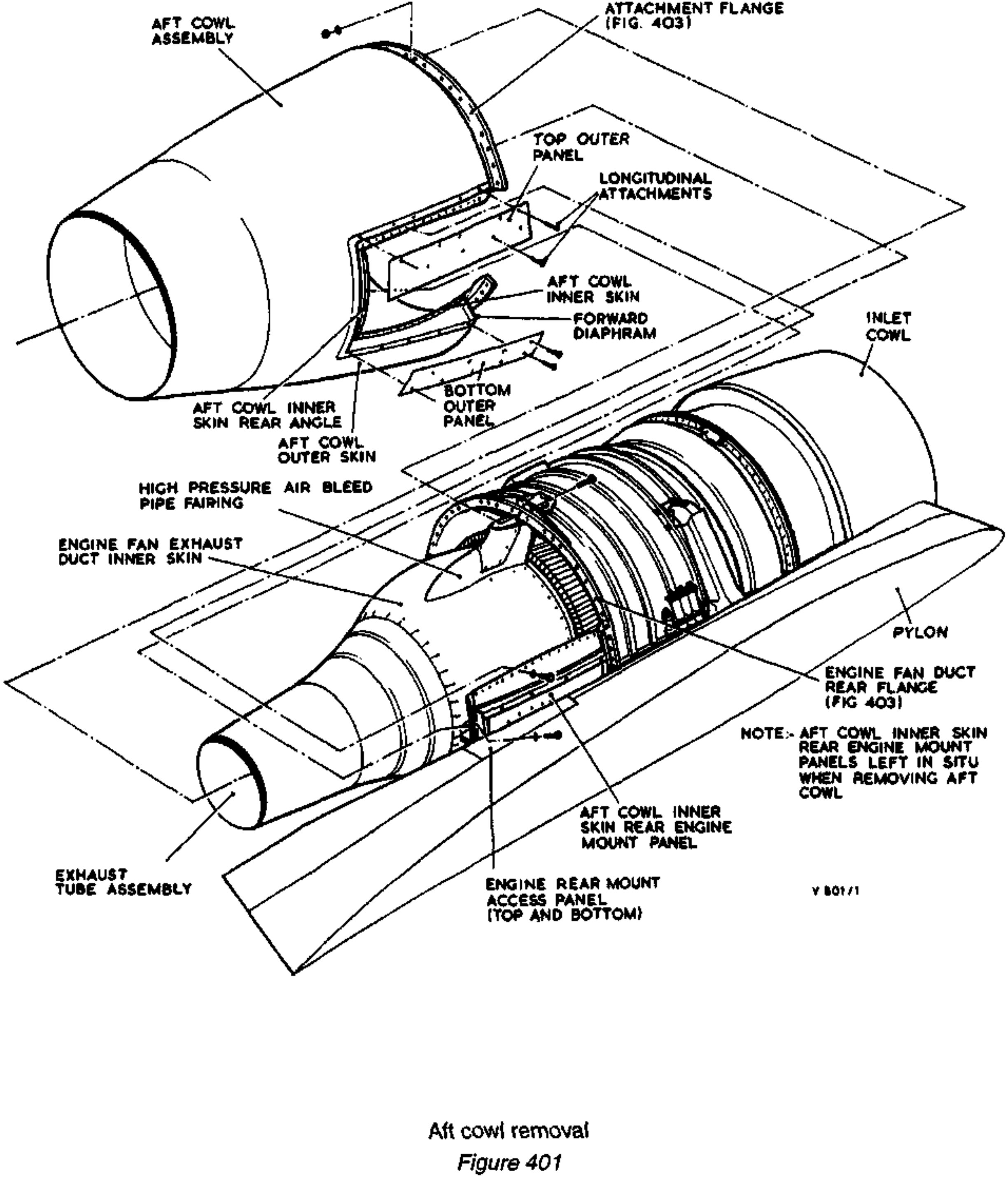
(a) Support the exhaust tube assembly.

(b) Unscrew the exhaust tube clamp T-bolt self-locking high temperature nuts, remove the clamp and withdraw the exhaust tube assembly rearwards.

(c) Seal off exhaust fan duct aperture on the engine.

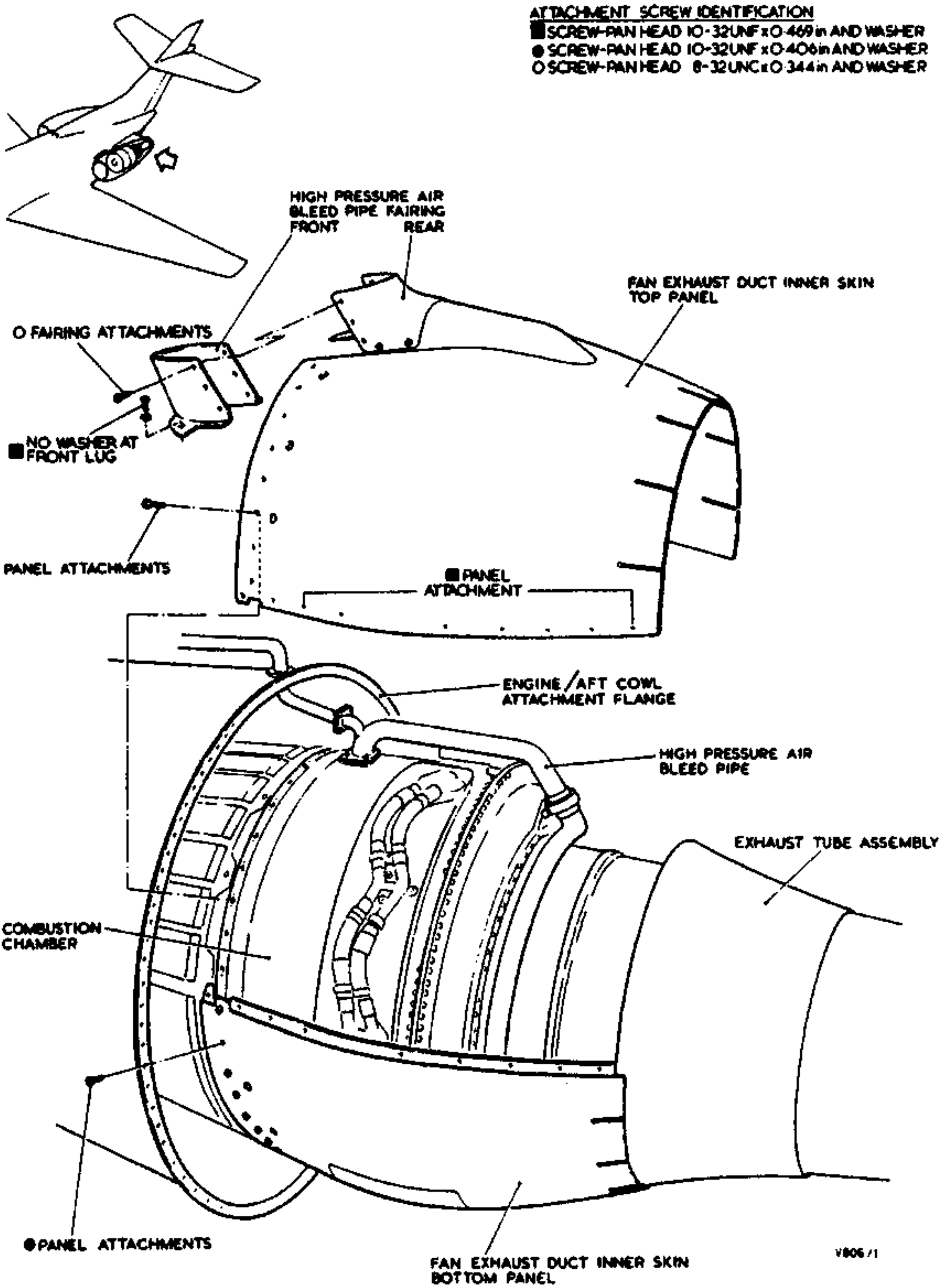
(8) Thrust and exhaust nozzle removal only. Dismantle engine rear mount fairing *(Figure 403 and Figure 404)*.

(a) Remove bolts etc. (6 off) securing upper fairing to the lower fairing.


AFT COWL ASSEMBLY
AFT COWL TO ENGINE ATTACHMENT FLANGE (FIG. 403)
TOP OUTER PANEL
LONGITUDINAL ATTACHMENTS
AFT COWL INNER SKIN
FORWARD DIAPHRAM
INLET COWL
BOTTOM OUTER PANEL
AFT COWL INNER SKIN REAR ANGLE
AFT COWL OUTER SKIN
HIGH PRESSURE AIR BLEED PIPE FAIRING
ENGINE FAN EXHAUST DUCT INNER SKIN
PYLON
ENGINE FAN DUCT REAR FLANGE (FIG 403)
NOTE:- AFT COWL INNER SKIN REAR ENGINE MOUNT PANELS LEFT IN SITU WHEN REMOVING AFT COWL
AFT COWL INNER SKIN REAR ENGINE MOUNT PANEL
EXHAUST TUBE ASSEMBLY
ENGINE REAR MOUNT ACCESS PANEL (TOP AND BOTTOM)
V 801/1

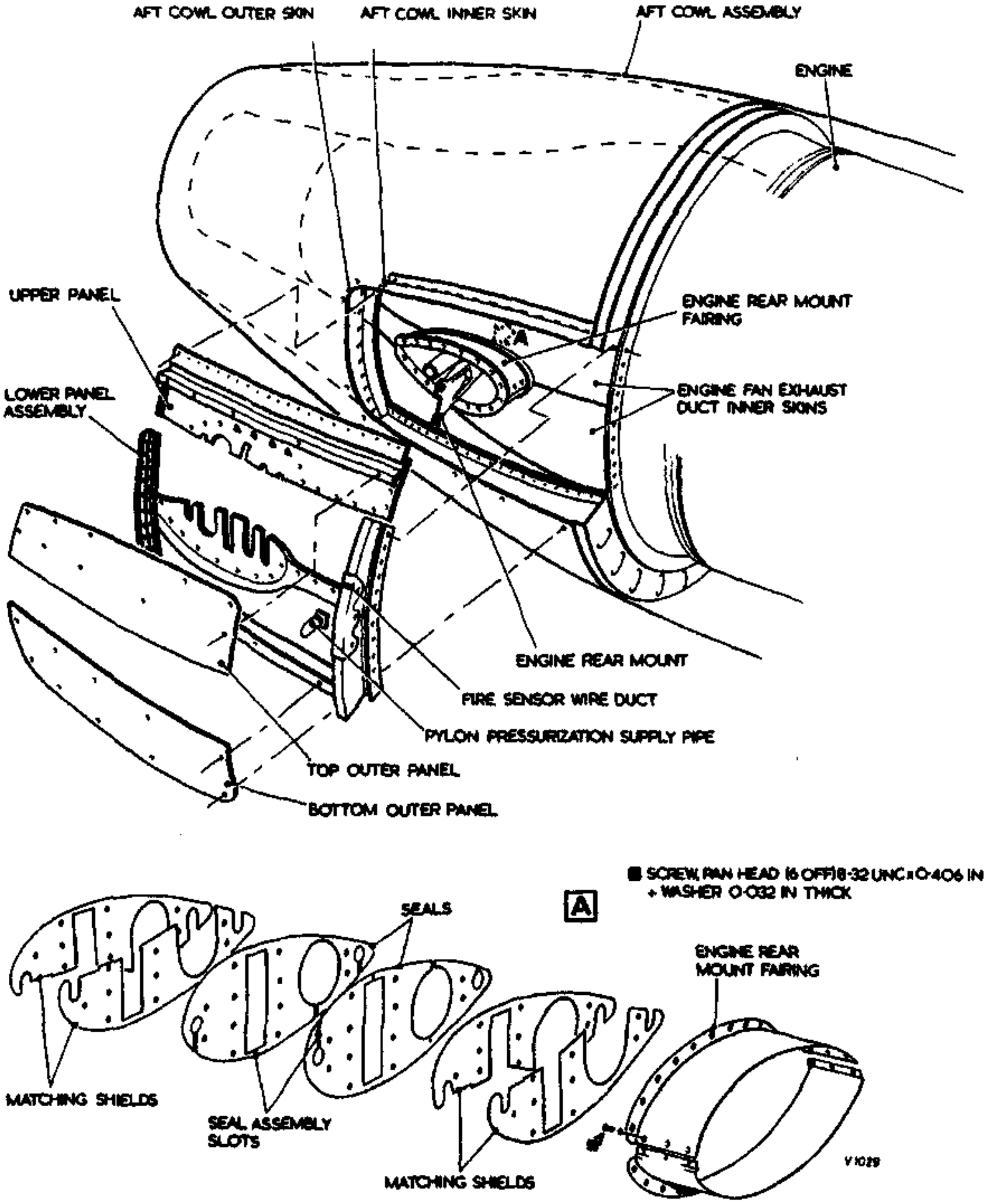
Aft cowl removal

*Figure 401*


ATTACHMENT SCREW IDENTIFICATION
■ SCREW-PAN HEAD 10-32UNF x 0.469in AND WASHER
● SCREW-PAN HEAD 10-32UNF x 0.406in AND WASHER
○ SCREW-PAN HEAD 8-32UNC x 0.344in AND WASHER
HIGH PRESSURE AIR BLEED PIPE FAIRING
FRONT
REAR
FAN EXHAUST DUCT INNER SKIN TOP PANEL
○ FAIRING ATTACHMENTS
■ NO WASHER AT FRONT LUG
● PANEL ATTACHMENTS
■ PANEL ATTACHMENT
ENGINE/AFT COWL ATTACHMENT FLANGE
HIGH PRESSURE AIR BLEED PIPE
EXHAUST TUBE ASSEMBLY
COMBUSTION CHAMBER
● PANEL ATTACHMENTS
FAN EXHAUST DUCT INNER SKIN BOTTOM PANEL
V806/1

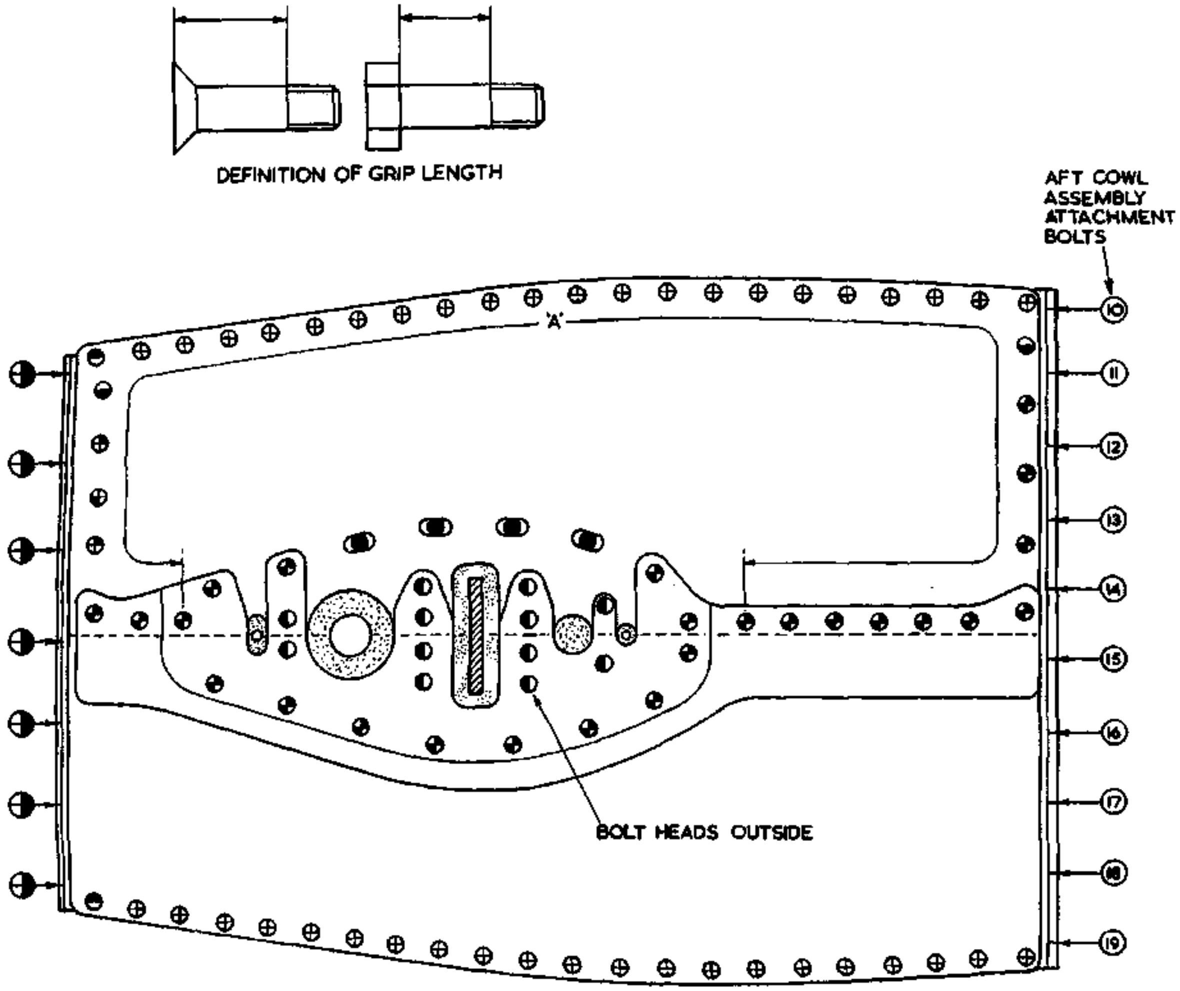
Fan exhaust duct inner top and bottom skin panels removal

*Figure 402*



Engine rear mount fairings

*Figure 403*

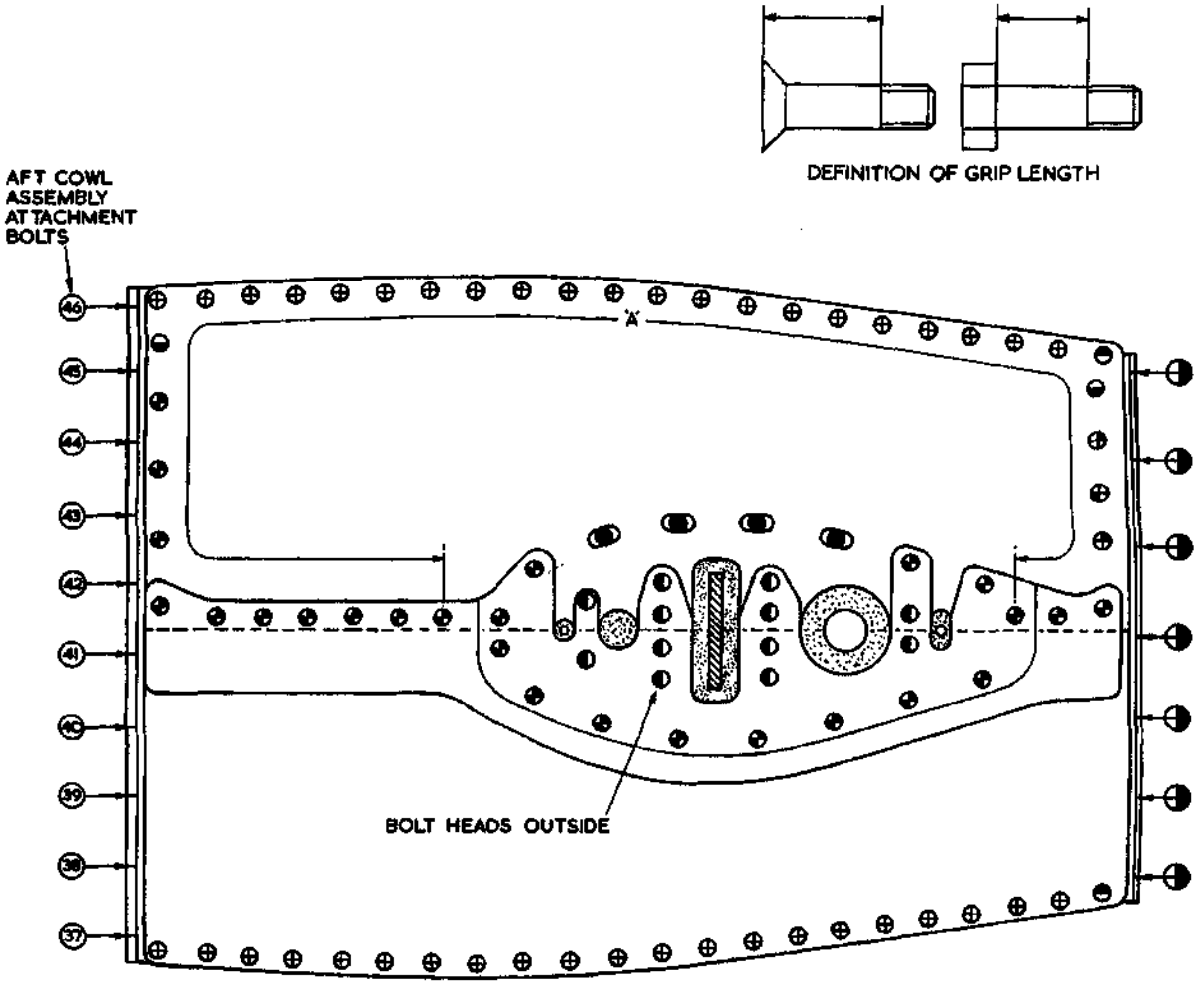


┌NOTE
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

● SCREW-CSK-10-32 UNF x 0.18 IN
⊖ SCREW-CSK-10-32 UNF x 0.23 IN + THIN WASHER + LOCKNUT
⊕ SCREW-CSK-10-32 UNF x 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT
⊕ SCREW-CSK-10-32 UNF x 0.23 IN + LOCKNUT
◕ SCREW-CSK-10-32 UNF x 0.23 IN
◐ BOLT-HEX HD-10 UNF 2A x 0.50 IN + LOCKNUT
⊕ BOLT-HEX HD-10-32UNF x 0.250 IN + THIN WASHER
⊖ BOLT-HEX HD-10-32UNF x 0.312 IN + THIN WASHER
◑ BOLT-HEX HD-10-32UNF x 0.125 IN

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT
V1036
HA00B999067AA

Engine rear mount fairing attachments - left engine
*Figure 404 (Sheet 1 of 2)*



NOTE
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

● SCREW-CSK-10-32UNF × 0.18 IN
⊖ SCREW-CSK-10-32UNF × 0.23 IN + THIN WASHER + LOCKNUT
⊕ SCREW-CSK-10-32UNF × 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT
⊕ SCREW-CSK 10-32UNF × 0.23 IN + LOCKNUT
⊕ SCREW-CSK-10-32UNF × 0.23 IN
◐ BOLT-HEX HD-10UNF 2A × 0.50 IN + LOCKNUT
⊕ BOLT-HEX HD-10-32UNF × 0.250 IN + THIN WASHER
⊖ BOLT-HEX HD-10-32UNF × 0.312 IN + THIN WASHER
⊕ BOLT-HEX HD-10-32UNF × 0.125 IN

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

V1037
HA00B969063AA

Engine rear mount fairing attachments - right engine
*Figure 404 (Sheet 2 of 2)*

(b) Remove bolts securing upper fairing to upper panel. Stow bolts etc. in the aide-memoire panel.

(c) Remove remaining bolts securing upper panel to lower panel assembly. Stow bolts etc. in the aide-memoire panel.

(d) Remove bolts etc. from the matching half-shields and seals. Stow bolts in the aide-memoire panel. Remove matching half-shields and seals.

(9) Disconnect N1 services *(Figure 405)*.

(a) Remove four bolts securing the terminal cover and remove the cover.

(b) Loosen locknuts, disconnect N1 monopole connector plug coded TVI (left engine) or TWI (right engine).

(10) Unclip N1 services.

(a) Lift the N1 cable clear of the rear cut-out in the lower panel assembly at the engine rear mount.

(b) Unclip the N1 cable at the engine hot end *(Figure 406)*.

**CAUTION: WHEN MANIPULATING THE N1 CABLE, AVOID EXCESSIVE BENDING AND KINKING.**

### C. Group 2 close up

| Equipment/Material | Part/Item No. |
|---|---|
| Torque wrench capable of 45 lbf/in. | – |

General

(1) Self-locking nuts.

(a) Do check of the run down torque manually. Attempt to screw self-locking nut on to the bolt beyond the self-locking section using maximum finger pressure. If the nut can be screwed beyond the self-locking section, reject it. Obtain a new nut and repeat check.

Close up

(2) Thrust and exhaust nozzle installation only.

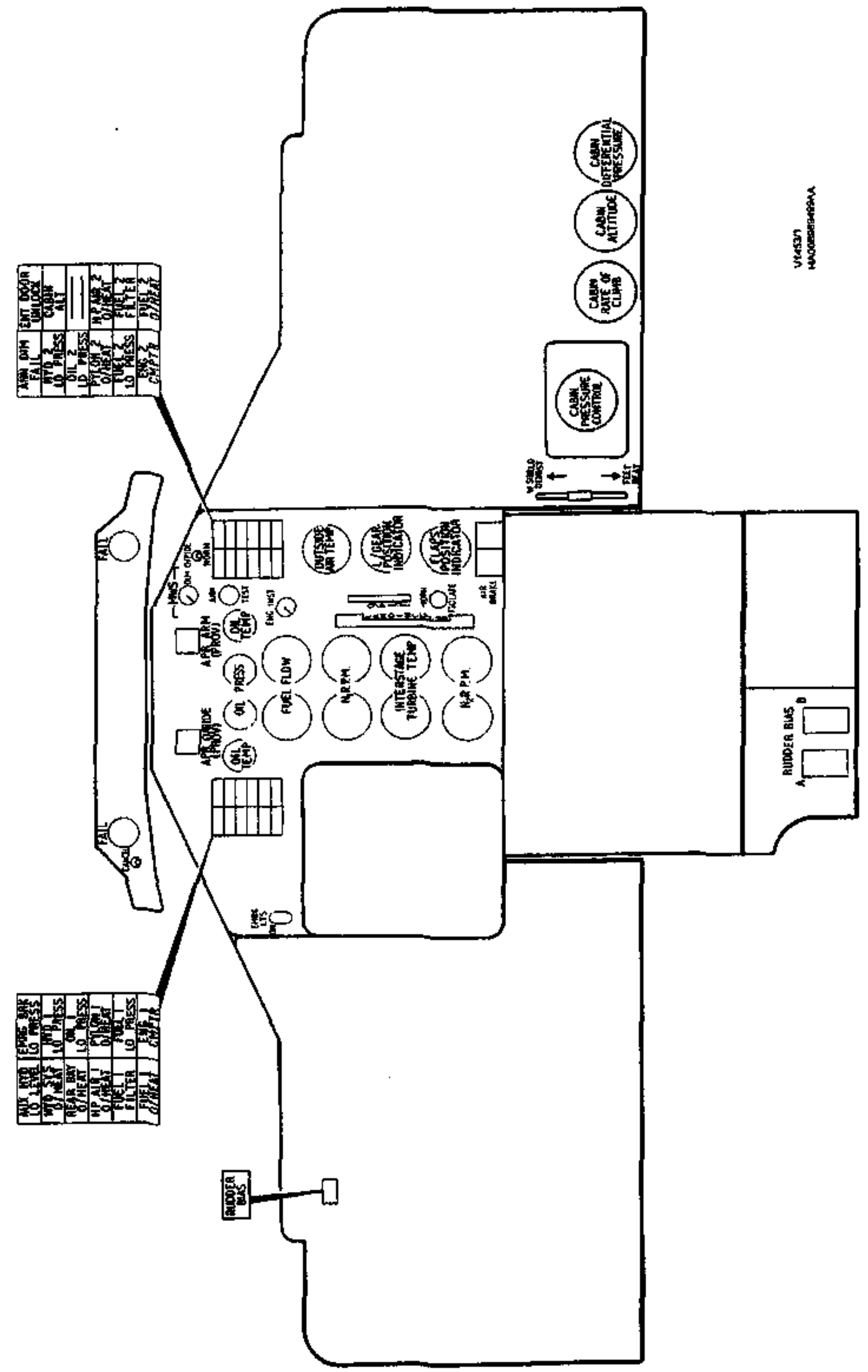
Connect and clip up N1 services *(Figure 405)*.

(a) Connect N1 monopole connector plug coded TVI (left engine) or TWI (right engine).

(b) Lay N1 cable across the rear cut-out in the lower access panel at the engine rear mount.

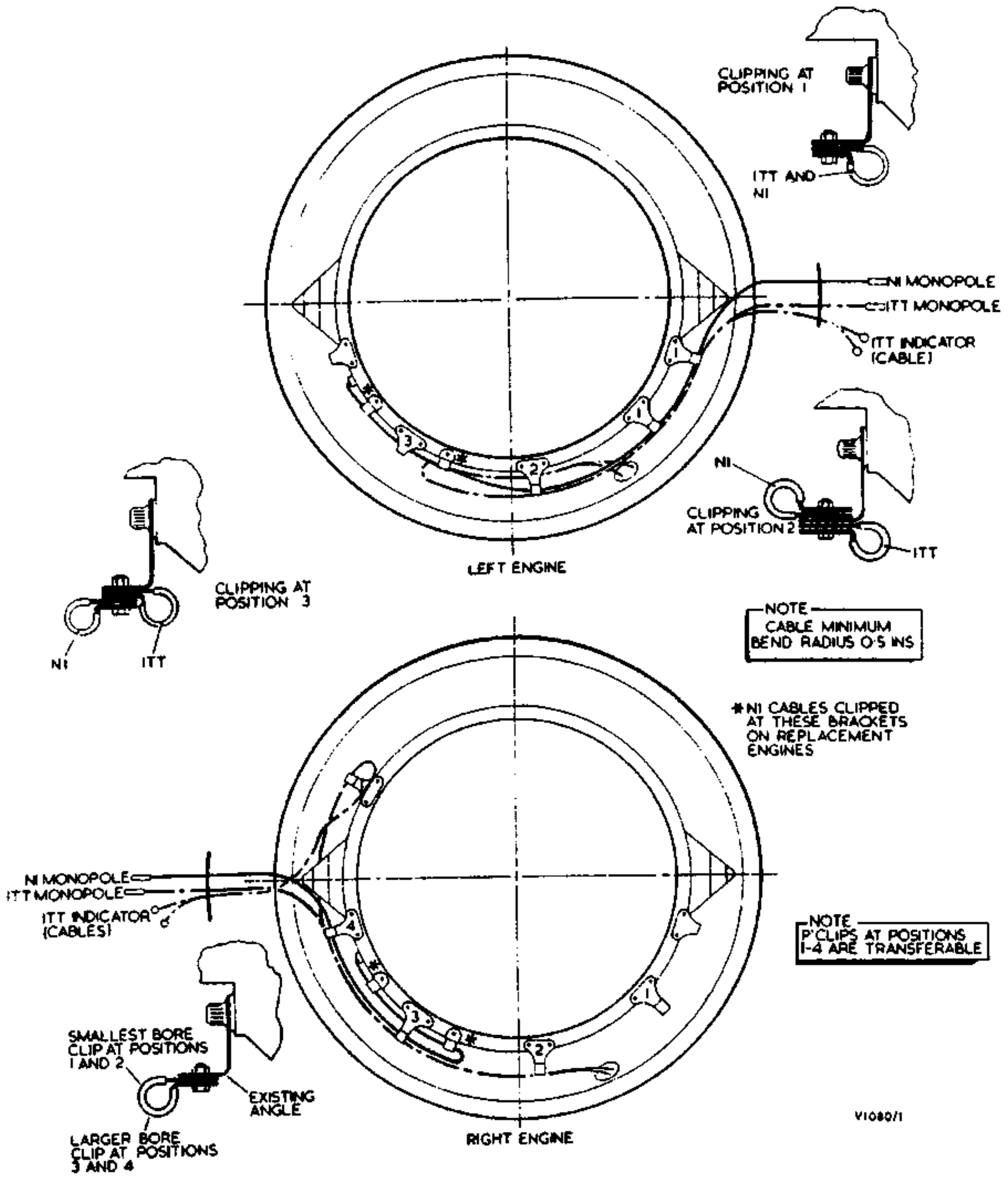
(c) Pull cable straight without tension. Clip up cable at engine hot end *(Figure 406)* using the P-clips, bolts, washers and stiffnuts obtained at disassembly.

**CAUTION: MINIMUM BEND RADIUS OF CABLE TO BE LESS THAN 0.50 IN.**



Power plant services connections details - electrical (typical)

*Figure 405*



Clipping of N1 and ITT services

*Figure 406*

(3) Install engine rear mount fairing *(Figure 403 and Figure 404)*.

(a) Connect upper panel to the lower panel assembly using the pertinent bolts, washers and nuts from the aide-memoire panel and tighten the bolts (17 off).

(b) Install two matching shields to abut the upper panel and lower panel assembly.

(c) Install the seals, one with assembly slots uppermost and one with assembly slots lowermost, making sure that the N1 cable and the slotted bush (on the fire detection system sensor) seat correctly.

(d) Install the remaining pair of matching shields, bolt up shields and seals (12 bolts) using bolts etc. from the aide-memoire panel.

**CAUTION: DO NOT OVERTIGHTEN THESE BOLTS.**

(e) Install the upper fairing (9 bolts) using the bolts from the aide-memoire panel.

(f) Connect the upper fairing to the lower fairing.

(4) Install exhaust pipe and tube assembly.

(a) Position the exhaust pipe complete with exhaust tube to the thrust and exhaust nozzle, making sure that the integral dowel pin correctly seats in its mating hole in the exhaust nozzle flange.

(b) Install the two halves of the exhaust clamp jointing them with their T-bolts. Screw on the high temperature nuts an equal amount on each bolt. Torque tighten each nut to 45 lbf/in. then lightly tap the circumference of the clamp halves with a non-metallic mallet. Do a check and retorque each nut. Repeat the bedding down with the mallet and retorque each nut.

(5) Install fan exhaust duct inner top and bottom skin panels *(Figure 402)*.

*NOTE: Tighten all screws progressively around the forward periphery.*

(a) Position and support the bottom panel, making sure that it seats correctly on the engine rear mount lower fairing. Avoid contact with the fire detection system sensor.

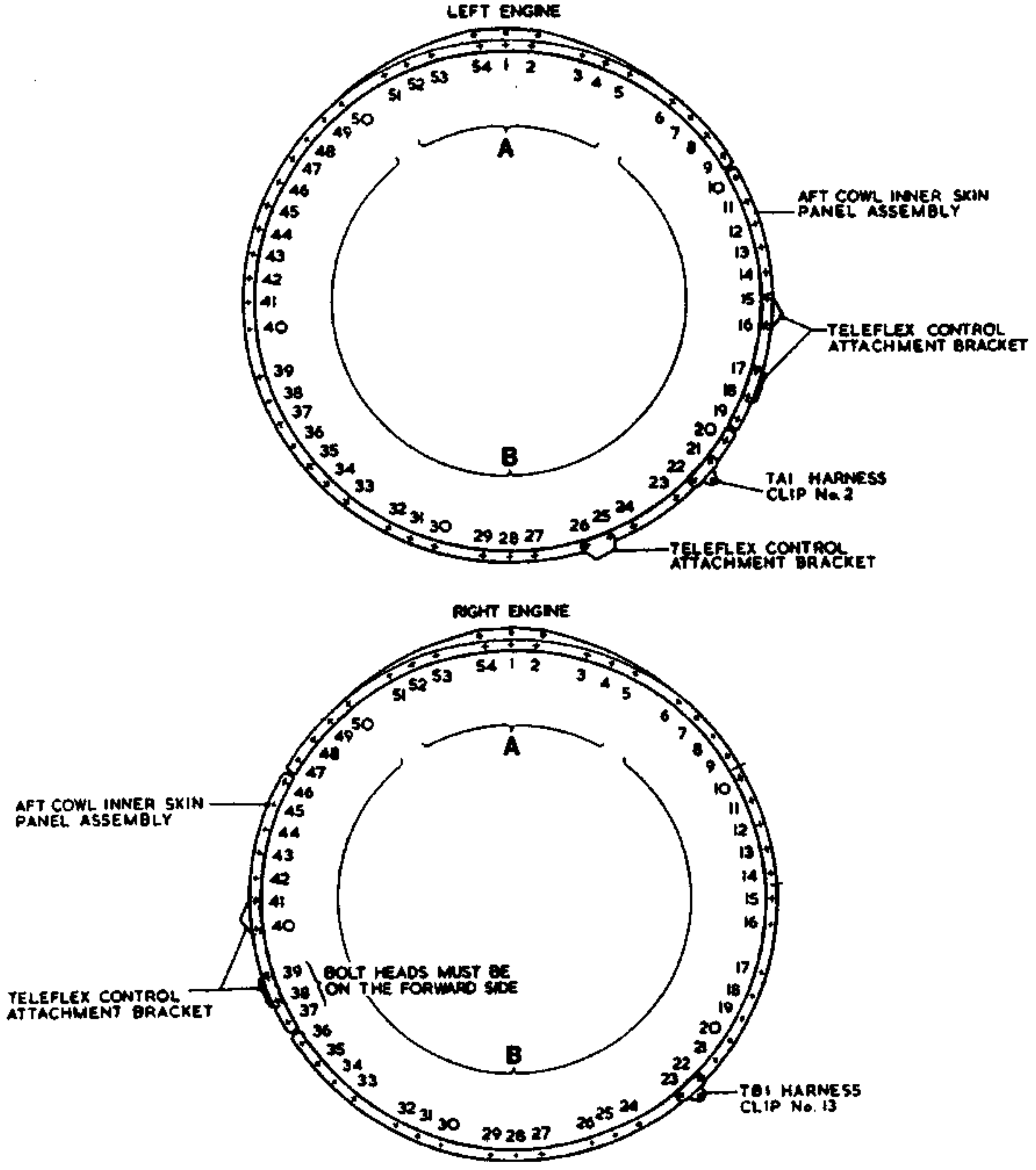
(b) Attach the panel at the forward periphery using screws and washers.

(c) Lay top panel in position making sure that it seats correctly on the engine rear mount upper fairing.

(d) Attach the panel at the forward periphery and horizontal joints using screws and washers.

(e) When located and secured, make sure the top and bottom panels fit snugly around the exhaust tube assembly and make sure all air holes and slots are unobstructed.

(f) Install the front fairing at the high pressure air bleed pipe using screws/bolts and washers.


LEFT ENGINE
A
B
AFT COWL INNER SKIN PANEL ASSEMBLY
TELEFLEX CONTROL ATTACHMENT BRACKET
TAI HARNESS CLIP No.2
TELEFLEX CONTROL ATTACHMENT BRACKET
RIGHT ENGINE
A
B
AFT COWL INNER SKIN PANEL ASSEMBLY
TELEFLEX CONTROL ATTACHMENT BRACKET
BOLT HEADS MUST BE ON THE FORWARD SIDE
TBI HARNESS CLIP No. 13

BOLT LOCATIONS (LOOKING FORWARD)

| HOLE REFERENCE No | BOLT | |
|---|---|---|
| | DIA | GRIP LENGTH |
| A {1 – 5<br>51 – 54} | 10/32 UNF | 0.562 IN |
| B 6 – 50 | 10/32 UNF | 0.312 IN |

WASHERS FITTED TO ALL BOLTS

V764/1

Aft cowl attachment

*Figure 407*

(6) Install aft cowl assembly *(Figure 401).*

(a) Position the cowl assembly making sure that its attachment holes align with the attachment holes in the engine flange and with the vacant holes in the upper panel and lower panel assembly at the engine rear mount.

(b) Left engine - Install cowl attachment bolts, washers and nuts *(Figure 407).*

| | |
|---|---|
| 1-9 | |
| 10-14 | Already installed. |
| 15-18 | Remember to connect Teleflex attachment brackets. |
| 19 | Already installed. |
| 20 | |
| 21-22 | Remember to connect TA1/TA3 harness clip No.2 bracket. |
| 23-24 | |
| 25-26 | Remember to connect Teleflex attachment bracket. |
| 27-54 | |

(c) Right engine - Install cowl attachment bolts, washers and nuts.

| | |
|---|---|
| 1-21 | |
| 22-23 | Remember to connect TB1/TB3 harness clip No.13 bracket. |
| 24-37 | |
| 38-41 | Remember to connect Teleflex attachment brackets. |
| 42-47 | Already installed. |
| 48-54 | |

(d) Tighten all bolts.

(e) Install remaining bolts from aide-memoire panel to the horizontal edges and aft edge of the upper panel and lower panel assembly.

(f) Install exhaust pipe blank.

(g) Install the aft cowl assembly top and bottom outer closing panels at the engine rear mount.

(7) Install the engine rear mount access panels to the pylon top and bottom surfaces.

(8) Install upper panel.

(a) Locate the panel on the engine and make sure that its hinge bars do not damage local electrical cables or looms.

(b) Align bolt holes (3 off) at the forward edge of the panel and install securing bolts but do not tighten at this stage.

(c) Align the panel shear pins (2 off) with their assembly housings on the aft cowl assembly. Close the shear pin latches.

(d) Tighten the panel securing bolts installed in paragraph (b).

(9) Install lower access door.

(a) Position the door up to the hinge bars on the upper panel. Close the hinge latches and check for flush seat.

(b) Close the door, push in the latches and make sure that they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (Chapter 71-10-00, SERVICING).*

(10) Restore electrical supplies by installing fuses and/or closing circuit breakers (Table 401).

**D. Group 2 - Adjustment/Test**

(1) Ground test the engine - Refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

***Table 401 (Series F400)***
**ENGINES - POWER SUPPLIES**

| Circuit | | Sub-panel D - circuit breaker | Sub-panel E - circuit breaker | Panel ZK - fuse | Panel ZL - fuse |
|---|---|---|---|---|---|
| Fuel filter | Left<br>Right | -<br>- | -<br>- | -<br>- | F16<br>F17 |
| Fuel temperature | Left<br>Right | -<br>- | -<br>- | -<br>- | F18<br>F19 |
| Oil low pressure | Left<br>Right | -<br>- | -<br>- | -<br>- | F21<br>F22 |
| Oil temperature | Left<br>Right | -<br>- | B21<br>B22 | -<br>- | -<br>- |
| Oil pressure | Left<br>Right | B15<br>B16 | -<br>- | -<br>- | -<br>- |
| Fuel flowmeter | Left<br>Right | -<br>- | -<br>- | F38, F39<br>F38, F48 | -<br>- |
| Fire detection | Left<br>Right | -<br>B22 | -<br>- | -<br>- | F12<br>F11 |
| Engine/intake de-ice | Left<br>Right | B50<br>B51 | -<br>- | F24<br>F25 | -<br>- |
| Engine r.p.m. | Left<br>Right | -<br>- | -<br>- | F34, F35, F44, F45<br>F29, F30, F54, F55 | -<br>- |
| I.T.T. | Left<br>Right | -<br>- | -<br>- | F28<br>F28 | -<br>- |
| Ignition | Left<br>Right | -<br>- | -<br>- | -<br>- | F5<br>F6 |
| No.1 fuel computer | | - | - | F10, F31 | - |
| No.2 fuel computer | | - | - | F11, F20, F32 | - |

# CHAPTER

# 73

# ENGINE FUEL AND CONTROL

# CHAPTER 73

# ENGINE FUEL AND CONTROL

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Removal/Installation 401

FUEL FILTER (BLOCKAGE) INDICATOR SWITCH 73-34-11
Removal/Installation 401

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| | 203 | Oct.99 |
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| | 402 | Oct.99 |
| 73-34-11 | 401 | Oct.99 |

# ENGINE
# SUB-ASSEMBLIES AND COMPONENTS
# REMOVAL/INSTALLATION

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF, AN ENGINE. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER SUCH COMPONENT IS REMOVED, IMMEDIATELY INSTALL A CAP TO THE APERTURE.**

NOTE: *The procedures required to gain access to the Allied Signal engine sub-assemblies and components to permit their removal from an installed power plant are grouped into "common access procedural" groups. Reference is also made to the pertinent Removal/Installation procedure detailed in the Allied Signal, Light Maintenance Manual, Report No.72-02-15.*

## 1. Group 1 - Procedure *(Figures 401, 402, 403, 404)*

### A. Group 1 - Sub-assemblies and components (*Refer to Allied Signal, Light Maintenance Manual)*

(1) Fuel manifold and splash shields. Chapter 73-10-01.

### B. Group 1 - Access procedure

NOTE: *Due to the complexity of the bolt-up arrangement at the engine rear mount fairing and the necessity for correct identification of bolts, nuts and washers during disassembly and assembly, it is recommended that an aide-memoire panel for storage of bolts etc., be locally manufactured. The panel can be made from thin metal or plywood using the layout given by Figure 404 Sheet 1 suitably enlarged. Drill holes using a 4.9 mm diameter drill and stencil LH on the obverse face and RH on the reverse face.*

(1) Remove lower access door:

(a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot and turn lever outboard to release. Open access door.

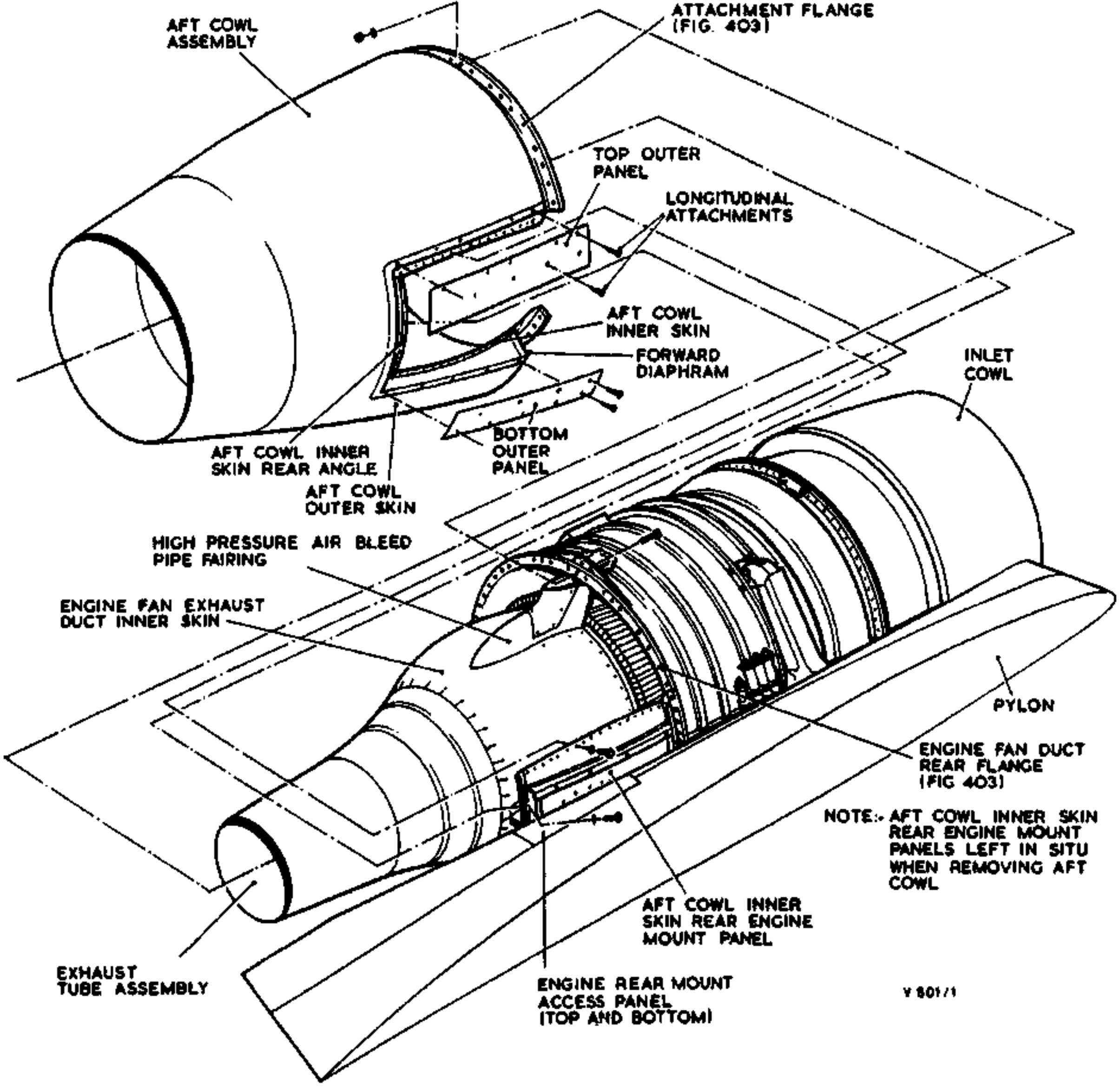
(b) With the door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into the facia hole and turn lever outboard to release. Remove door.

(2) Remove upper panel:

(a) At the aft edge of the panel, insert a suitable 0.25 in. diameter rod into the facia hole of each shear pin latch and turn lever outboard to release.

(b) At the forward end of the panel, remove the three countersunk bolts securing the panel to the inlet cowl. Carefully remove the panel making sure that its three hinge bars do not damage local electrical cables or looms.

(3) Remove engine rear mount access panels from pylon top and bottom surfaces.


AFT COWL ASSEMBLY
AFT COWL TO ENGINE ATTACHMENT FLANGE (FIG. 403)
TOP OUTER PANEL
LONGITUDINAL ATTACHMENTS
AFT COWL INNER SKIN
FORWARD DIAPHRAM
INLET COWL
AFT COWL INNER SKIN REAR ANGLE
BOTTOM OUTER PANEL
AFT COWL OUTER SKIN
HIGH PRESSURE AIR BLEED PIPE FAIRING
ENGINE FAN EXHAUST DUCT INNER SKIN
PYLON
ENGINE FAN DUCT REAR FLANGE (FIG 403)
NOTE:- AFT COWL INNER SKIN REAR ENGINE MOUNT PANELS LEFT IN SITU WHEN REMOVING AFT COWL
AFT COWL INNER SKIN REAR ENGINE MOUNT PANEL
EXHAUST TUBE ASSEMBLY
ENGINE REAR MOUNT ACCESS PANEL (TOP AND BOTTOM)
V 801/1

Aft cowl removal

*Figure 401*

(4) Remove aft cowl assembly *(Figure 401)*:

(a) Remove aft cowl assembly top and bottom outer closing panels at the engine rear mount.

(b) Remove bolts etc. from the longitudinal edges of the upper panel/lower panel assembly and aft cowl inner skin *(Figure 402)*. Stow the attachments in the aide-memoire panel.

(c) Remove bolts connecting the rear angle to the aft cowl inner skin Stow bolts in the aide-memoire panel.

*NOTE: The upper panel and lower panel assembly are left connected to the attachment flange on the engine.*

(d) Disconnect electrical leads and pipes from their P-clips on the aft cowl forward diaphragm.

(e) Support the aft cowl assembly then remove nuts, washers and bolts from aft cowl/engine fan duct flange (except at attachment locations 10-19 (left engine) or 37-46 (right engine)).

(f) Withdraw the aft cowl assembly rearward.

(5) Remove fan exhaust duct inner top and bottom skin panels *(Figure 403)*:

(a) Remove screws and washers securing high pressure air bleed pipe front fairing to top panel and remove fairing.

(b) Remove screws and washers from top panel forward periphery and longitudinal lap joints and remove top panel.

(c) Support bottom panel, remove screws and washers at forward periphery and remove bottom panel.

### C. Group 1 - close up

(1) Self-locking nuts.

(a) Do a check of the run down torque manually. Attempt to screw self-locking nut on to the bolt beyond the self-locking section using maximum finger pressure. If the nut can be screwed beyond the self-locking section, reject it. Obtain new nut/s and repeat the check.

Close-up.

(2) Install fan exhaust duct inner top and bottom skin panels *(Figure 403)*:

*NOTE: Tighten all screws progressively around the forward periphery.*

(a) Position and support the bottom panel, making sure that it seats correctly on the engine rear mount lower fairing. Make sure to avoid contact with the fire detection system sensor.

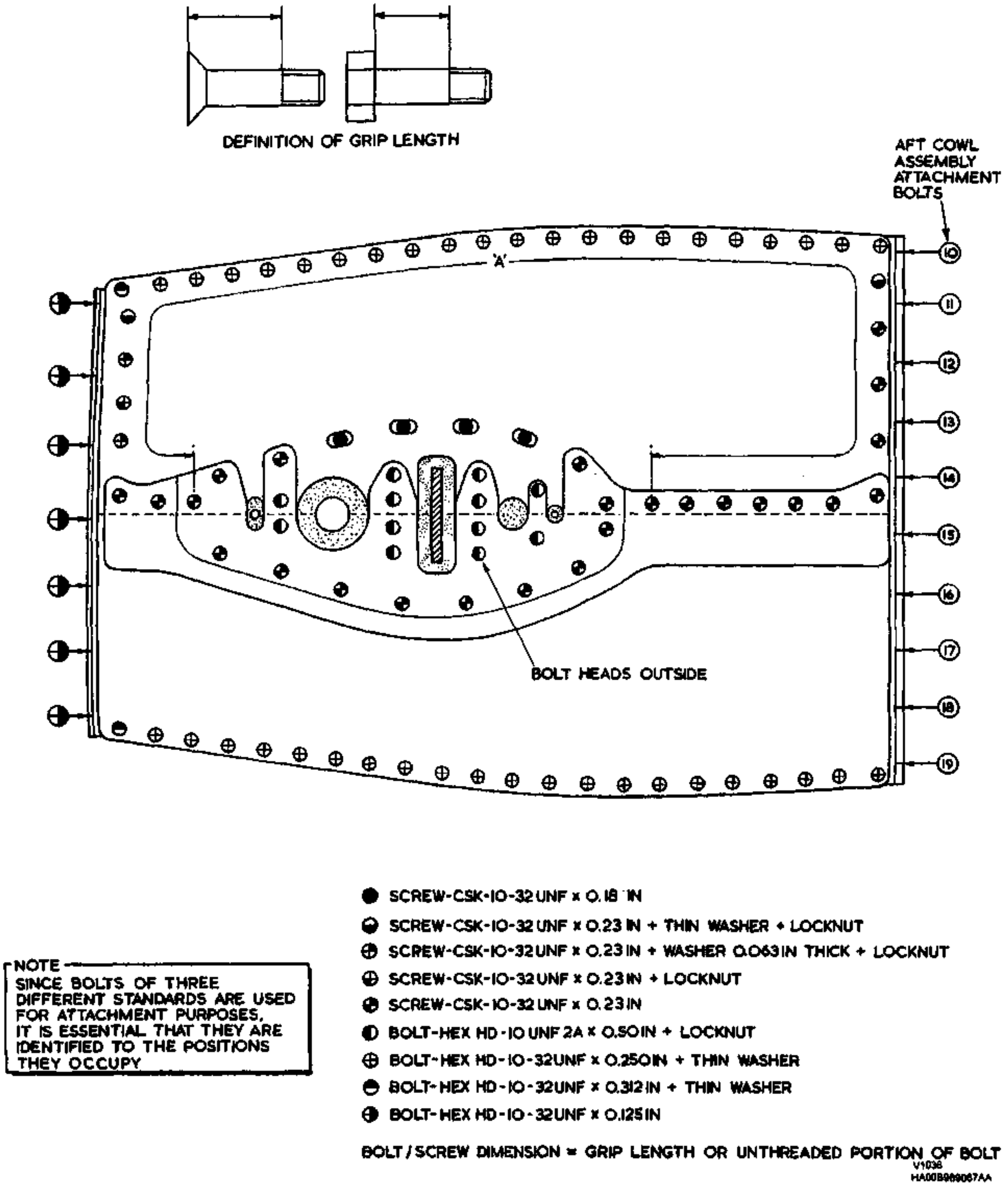
(b) Attach the panel at the forward periphery using screws and washers.

(c) Lay the top panel in position making sure that it seats correctly on the engine rear mount upper fairing.

(d) Attach the panel at the forward periphery and horizontal joints using screws and washers.

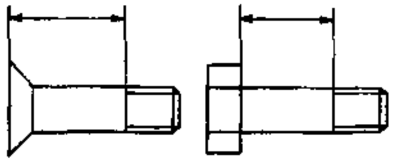
(e) When located and secured, make sure the top and bottom panels fit snugly around the exhaust tube assembly and make sure all air holes and slots are unobstructed.

(f) Install the front fairing at the high pressure air bleed pipe using screws/bolts and washers.

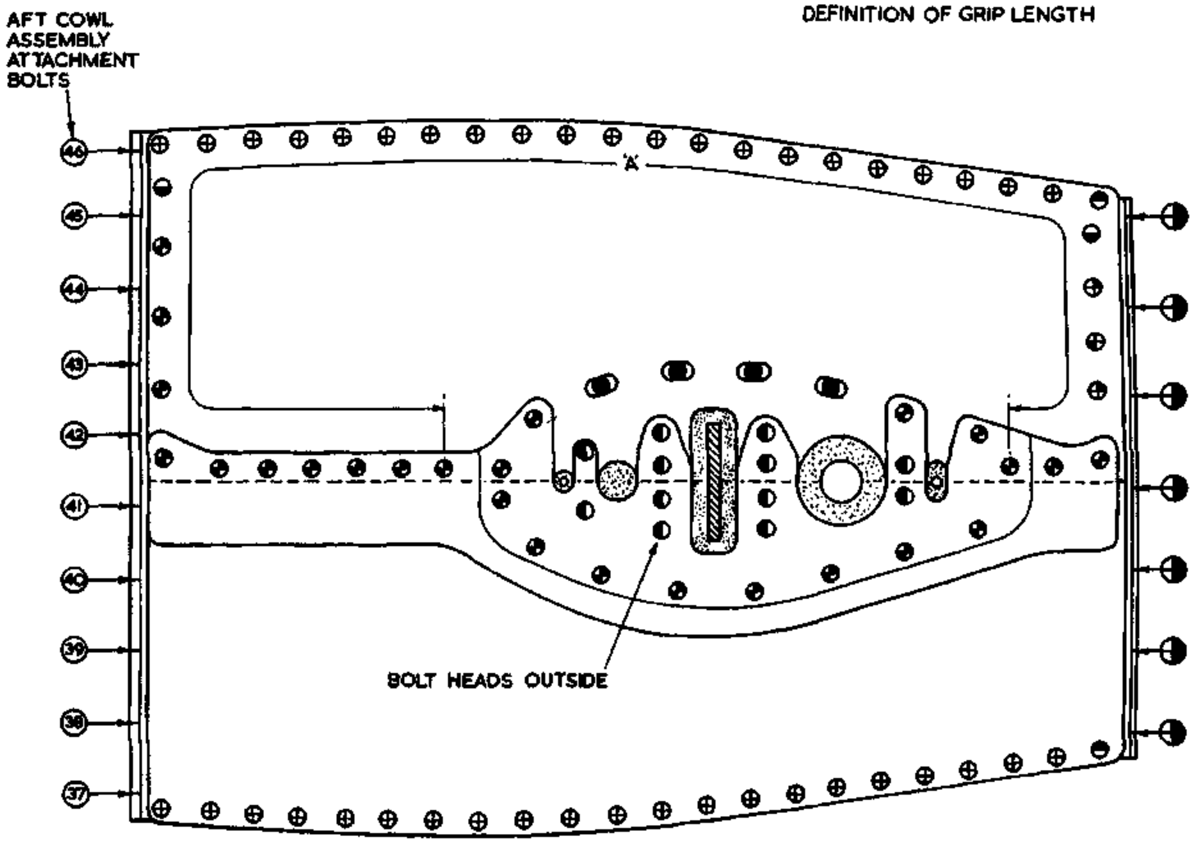

DEFINITION OF GRIP LENGTH
AFT COWL ASSEMBLY ATTACHMENT BOLTS
'A'
⑩
⑪
⑫
⑬
⑭
⑮
⑯
⑰
⑱
⑲
BOLT HEADS OUTSIDE
● SCREW-CSK-10-32 UNF x 0.18 IN
◒ SCREW-CSK-10-32 UNF x 0.23 IN + THIN WASHER + LOCKNUT
⊕ SCREW-CSK-10-32 UNF x 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT
⊕ SCREW-CSK-10-32 UNF x 0.23 IN + LOCKNUT
● SCREW-CSK-10-32 UNF x 0.23 IN
◐ BOLT-HEX HD-10 UNF 2A x 0.50 IN + LOCKNUT
⊕ BOLT-HEX HD-10-32UNF x 0.250 IN + THIN WASHER
◓ BOLT-HEX HD-10-32UNF x 0.312 IN + THIN WASHER
◑ BOLT-HEX HD-10-32UNF x 0.125 IN
BOLT / SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT
V1036
HA00B989067AA

NOTE
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

Engine rear mount fairing attachments - left engine
*Figure 402 (Sheet 1 of 2)*



DEFINITION OF GRIP LENGTH



- ● SCREW-CSK-10-32UNF × 0.18 IN
- ◒ SCREW-CSK-10-32UNF × 0.23 IN + THIN WASHER + LOCKNUT
- ⊕ SCREW-CSK-10-32UNF × 0.23 IN + WASHER 0.063 IN THICK + LOCKNUT
- ⊕ SCREW-CSK 10-32UNF × 0.23 IN + LOCKNUT
- ◕ SCREW-CSK-10-32UNF × 0.23 IN
- ◐ BOLT-HEX HD-10UNF 2A × 0.50 IN + LOCKNUT
- ⊕ BOLT-HEX HD-10-32UNF × 0.250 IN + THIN WASHER
- ◓ BOLT-HEX HD-10-32UNF × 0.312 IN + THIN WASHER
- ◑ BOLT-HEX HD-10-32UNF × 0.125 IN

NOTE

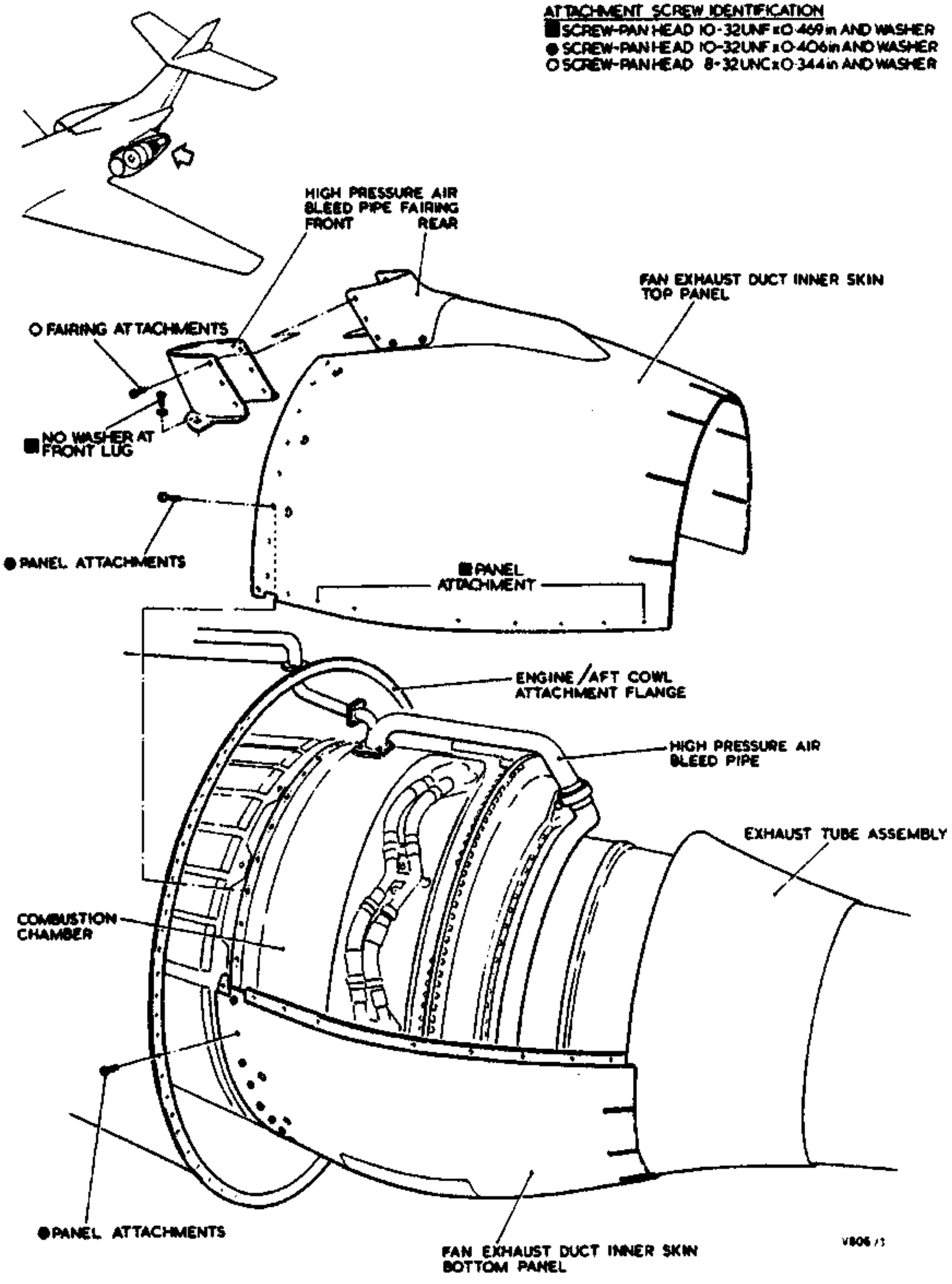
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

V1037
HA00B98906SAA

Engine rear mount fairing attachments - right engine

*Figure 402 (Sheet 2 of 2)*


ATTACHMENT SCREW IDENTIFICATION
■ SCREW-PAN HEAD 10-32UNF x 0·469 in AND WASHER
● SCREW-PAN HEAD 10-32UNF x 0·406 in AND WASHER
○ SCREW-PAN HEAD 8-32UNC x 0·344 in AND WASHER
HIGH PRESSURE AIR BLEED PIPE FAIRING
FRONT
REAR
FAN EXHAUST DUCT INNER SKIN TOP PANEL
○ FAIRING ATTACHMENTS
■ NO WASHER AT FRONT LUG
● PANEL ATTACHMENTS
■ PANEL ATTACHMENT
ENGINE/AFT COWL ATTACHMENT FLANGE
HIGH PRESSURE AIR BLEED PIPE
EXHAUST TUBE ASSEMBLY
COMBUSTION CHAMBER
● PANEL ATTACHMENTS
FAN EXHAUST DUCT INNER SKIN BOTTOM PANEL
V806 / 1

Fan exhaust duct inner top and bottom skins panels removal

*Figure 403*

(3) Install aft cowl assembly *(Figure 401)*:

(a) Position the cowl assembly making sure that its attachment holes align with the attachment holes in the engine flange and with the vacant holes in the upper panel and lower panel assembly at the engine rear mount.

(b) Left engine - Install cowl attachment bolts, washers and nuts *(Figure 404)*:

| | |
|---|---|
| 1-9 | |
| 10-14 | Already installed. |
| 15-18 | Remember to connect Teleflex attachment brackets. |
| 19 | Already installed. |
| 20 | |
| 21-22 | Remember to connect TA1/TA3 harness clip No.2 bracket. |
| 23-24 | |
| 25-26 | Remember to connect Teleflex attachment bracket. |
| 27-54 | |

(c) Right engine - Install cowl attachment bolts, washers and nuts *(Figure 404)*:

| | |
|---|---|
| 1-21 | |
| 22-23 | Remember to connect TB1/TB3 harness clip No.13 bracket. |
| 24-37 | |
| 38-41 | Remember to connect Teleflex attachment brackets. |
| 42-47 | Already installed. |
| 48-54 | |

(d) Tighten all bolts.

(e) Install bolts from aide-memoire panel to the horizontal edges and aft edge of the upper panel and lower panel assembly.

(f) Install exhaust pipe cover.

(g) Install the aft cowl assembly top and bottom outer closing panels at the engine rear mount.

(4) Install the engine rear mount access panels to the pylon top and bottom surfaces.

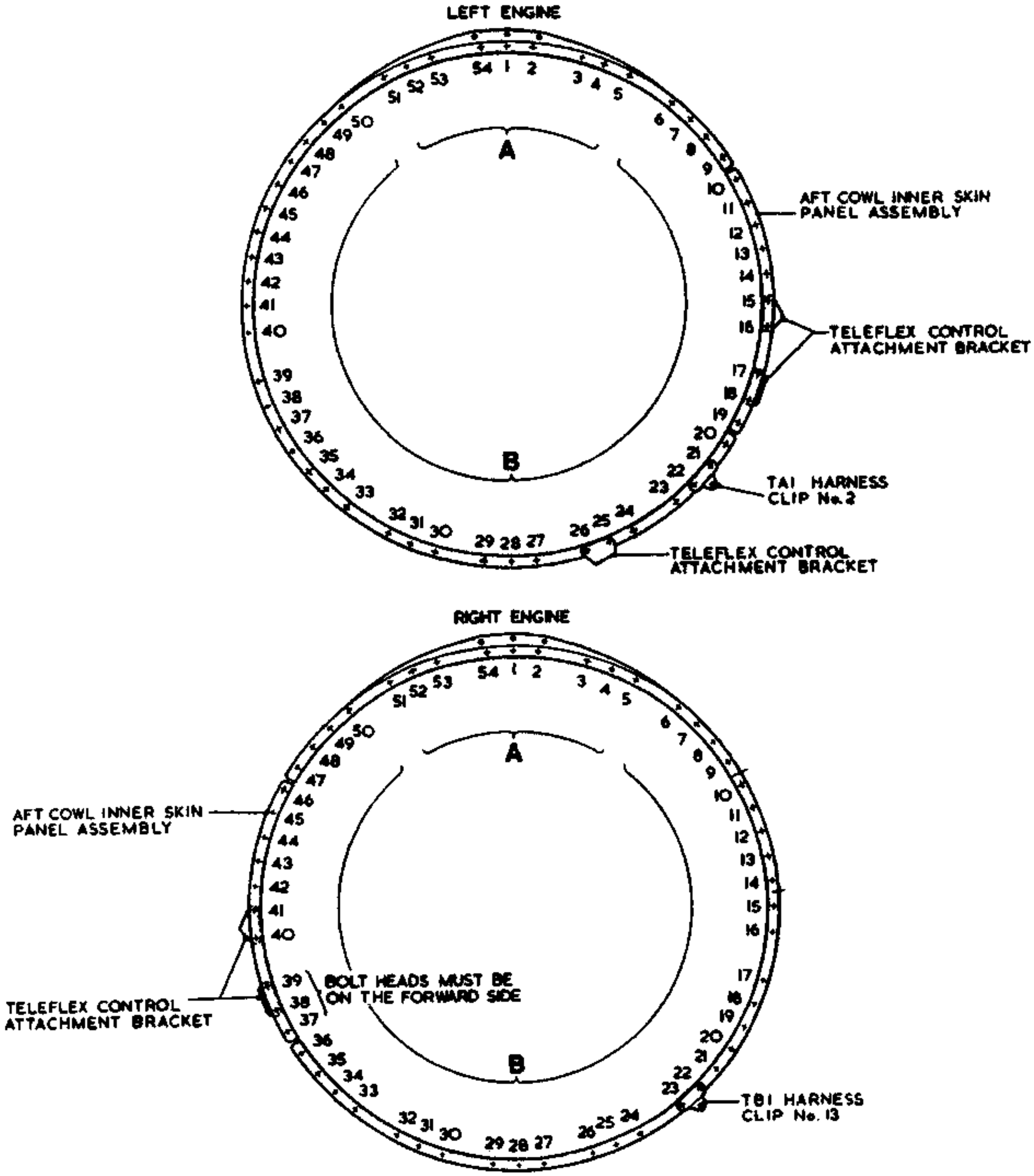
(5) Install the upper panel:

(a) Locate the panel on the engine making sure that its hinge bars do not damage local electrical cables or looms.

(b) Align bolt holes (3 off) at the forward edge of the pane. Install securing bolts but do not tighten at this stage.

(c) Align the panel shear pins (2 off) with their assembly housings on the aft cowl assembly. Close the shear pin latches.

(d) Tighten the panel securing bolts installed in paragraph (b).


LEFT ENGINE
A
B
AFT COWL INNER SKIN PANEL ASSEMBLY
TELEFLEX CONTROL ATTACHMENT BRACKET
TAI HARNESS CLIP No. 2
TELEFLEX CONTROL ATTACHMENT BRACKET
RIGHT ENGINE
A
B
AFT COWL INNER SKIN PANEL ASSEMBLY
TELEFLEX CONTROL ATTACHMENT BRACKET
BOLT HEADS MUST BE ON THE FORWARD SIDE
TBI HARNESS CLIP No. 13

BOLT LOCATIONS (LOOKING FORWARD)

| HOLE REFERENCE No | | BOLT | |
|---|---|---|---|
| | | DIA | GRIP LENGTH |
| A | 1 – 5<br>51 – 54 | 10/32 UNF | 0.562 IN |
| B | 6 – 50 | 10/32 UNF | 0.312 IN |

WASHERS FITTED TO ALL BOLTS

V764/1

Aft cowl attachment

*Figure 404*

(6) Install lower access door:

(a) Position the door up to its hinge bars on the upper panel. Close the hinge latches and make sure they seat flush.

(b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of door does not obstruct the breather pipe outlet (0.625 in. i/d.) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (Chapter 71-10-00, SERVICING).*

**D. Group 1 - Adjustment/Test**

(1) Ground test the engine - (Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST).

## 2. Group 2 - Procedure

**A. Group 2 - Sub-assemblies and components** *(Refer to Allied Signal, Light Maintenance Manual)*

| | |
|---|---|
| (1) Fuel control fluid pressure filter. | Chapter 73-21-01. |

**B. Group 2 - Access procedure**

(1) Remove lower access door:

(a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot and turn lever outboard to release. Open access door.

(b) With the door adequately supported and, at each outboard latch in turn, insert a suitable 0.25 in. diameter rod into the facia hole and turn lever outboard to release. Remove door.

**C. Group 2 - Close-up**

(1) Install lower access door.

(a) Position the door up to its hinge bars on the upper panel. Close the latch hinges and make sure they seat flush.

(b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d.) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (refer to Chapter 71-10-00, SERVICING).*

**D. Group 2 - Adjustment/test**

(1) Ground test the engine - (Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST).

# ELECTRONIC COMPUTER REMOVAL/INSTALLATION

## 1. Electronic Computer

*NOTE: Before removal, and after installation, of Electronic Computer refer to Allied Signal, Light Maintenance Manual - Report No.72-02-15, Chapter 76-10-02, MAINTENANCE PRACTICES.*

### A. Removal

(1) Remove appropriate fuses, (refer to Table 401 and Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(2) Uncouple the electrical harness socket from the plug on the computer.

(3) Disconnect the PT2 hose from the computer and unscrew and remove adapter and O-ring seal. Retain adapter but discard O-ring seal. Seal off the open end of the PT2 hose and the computer connections.

(4) Unscrew the computer platform knurled nuts and remove the computer.

### B. Installation

(1) Examine the platform anti-vibration mountings for damage or deterioration.

(2) Locate the electronic computer on its anti-vibration platform.

(3) Clamp the computer down by the platform knurled nuts.

(4) Remove the caps from the PT2 hose and computer connection. Use a new O-ring seal and install the adapter to the computer.

(5) Connect the PT2 hose to the computer and wire-lock.

(6) Couple the electrical harness socket to the computer and wire-lock.

(7) Drain the PT2 system piping (Chapter 73-20-21, PT2 DRAINS).

(8) Reinstall appropriate fuses.

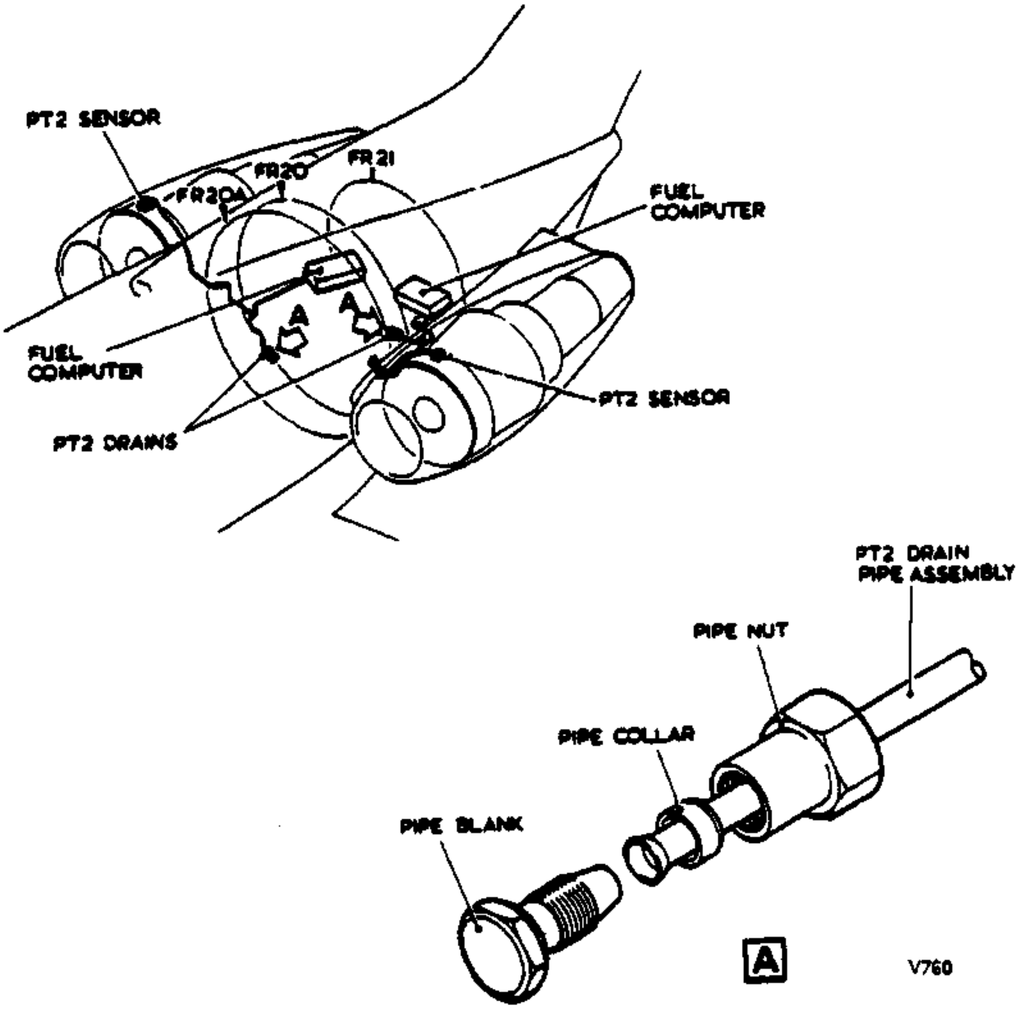
Table 401
ELECTRONIC COMPUTER
POWER SUPPLY DETAILS

| Equipment | Supply | Panel | Fuse |
|---|---|---|---|
| Computer Left or Right | PE | ZK | F10 |
| | PE | ZK | F11 |
| | PE2 | ZK | F20 |
| | PE2 | ZK | F31 |
| | PE2 | ZK | F32 |

# PT2 DRAINS
# DESCRIPTION AND OPERATION

## 1. General *(Figure 1)*

The engine intake air pressure (PT2) is piped from a sensor unit, located at '12 o'clock' on the engine fan duct, through the pylon to an electronic computer in the rear fuselage. Drain points are provided at the lowest level of each PT2 system in the rear fuselage to drain off water accrued through condensation.



PT2 drains system
Figure 1

# PT2 DRAINS
# SERVICING

## 1. Drain PT2 drains

### A. Procedure

(1) Remove the pipe cap from the drain point of the left and right PT2 system.

(2) Drain any water into a container.

(3) Install the pipe cap to the drain pipe and wire-lock.

# ENGINE SYNCHRONIZER REMOVAL/INSTALLATION

## 1. Engine Synchronizer

### A. Removal

(1) Open rear equipment bay door.

(2) Isolate electrical power supplies to synchronizer (Refer to Table 401 and Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(3) Remove electrical connectors, from the synchronizer, located on the fuselage keel just aft of the fuselage rear equipment bay door.

(4) Remove the four bolts and distance pieces securing the synchronizer to its panel and remove the synchronizer.

### B. Installation

| Equipment/Material | Part/Item No. |
|---|---|
| Sealant | 314 (Chapter 20-95-301) |
| Cleaning agent | 204 or 230 (Chapter 20-95-201) |
| Aluminium wool | – |

*NOTE: Mod.252735 introduces a bonding station positioned on the forward lower face of frame 22 and linked to the synchronizer panel by a copper bonding strap.*

(1) Clean mating faces of synchronizer feet, distance pieces, bonding strap and terminal lug on bonding lead.

(2) Attach synchronizer to panel making sure the bonding strap is sandwiched firmly between the distance pieces and mounting feet, and the terminal lug bonding lead is assembled under the bolt head.

(3) Tighten all bolts and coat the bolt head and terminal lug with sealant (Item 314). The measured resistance between the synchronizer and the bonding strap should not be more than 0.025 ohm.

(4) Connect the electrical connectors to the synchronizer and wire-lock.

(5) Restore electrical power supplies to the synchronizer.

(6) Ground test installation, refer to Chapter 71-00-00, ADJUSTMENT/TEST.

(7) Close rear equipment bay door.

Table 401
ENGINE SYNCHRONIZER
POWER SUPPLY DETAILS

| Equipment | Supply | Panel | Fuse |
|---|---|---|---|
| Engine synchronizer L.H. or R.H. | PE | ZK | F10 |
| | PE | ZK | F11 |
| | PE | ZK | F20 |
| | PE | ZK | F31 |
| | PE | ZK | F32 |

# ENGINE SYNCHRONIZER
# DESCRIPTION

*NOTE: A description and operation of the synchronizer is contained in the Allied Signal Light Maintenance Manual, Report No. 72-02-15, Chapter 76-10-10.*

## 1. General

In conjunction with the engine control computer, the aircraft is installed with an engine speed synchronizer. This facility enables the engine N1 or N2 spool speeds to be synchronized through operation of a ENG SYNC switch on the flight compartment roof panel.

The synchronizer operates on the master/slave principle wherein only the slave engine speed is adjusted to obtain synchronization. In this aircraft the left engine is the master and the right engine the slave.

# AUTOMATIC PERFORMANCE RESERVE (APR) SYSTEM DESCRIPTION AND OPERATION

*NOTE: A description of the APR system is also contained in the Allied Signal Light Maintenance Manual, Report No.72-02-15, Chapter 76-10-10.*

## 1. Description *(Figure 1 and Figure 2)*

### A. General

In the event of an engine failure or transient fault during take-off, or a "go-around" following a single engined approach, the armed APR system will permit the normal take-off rating of either or both engines to automatically reset to the higher APR rating.

*NOTE: There will be no increase in thrust if the ambient conditions are such that the engines are N1 r.p.m. limited (at normal rating).*

Increase in thrust is obtained by allowing the engine(s) to be run at higher operating limits. The N2 rotor speed increasing approximately 1% (max) and the interstage turbine temperature (ITT) rising approximately 22° C (max).

The APR system is powered from the PE busbar, and comprises, two mechanically latching, "push on/ push off" control switches in the flight compartment plus a control unit and (Pre-Mod.252719) an "event" counter in the rear equipment bay. In auto mode the system functions in conjunction with the engine synchronizer system.

When armed, APR will be triggered automatically if the engine N2 speed signals received from the synchronizer and compared by the APR control unit differ by more than 5% N2 (approx 12% N1).

When armed, to cater for an auto mode malfunction, the system may also be triggered by manual selection of O/RIDE.

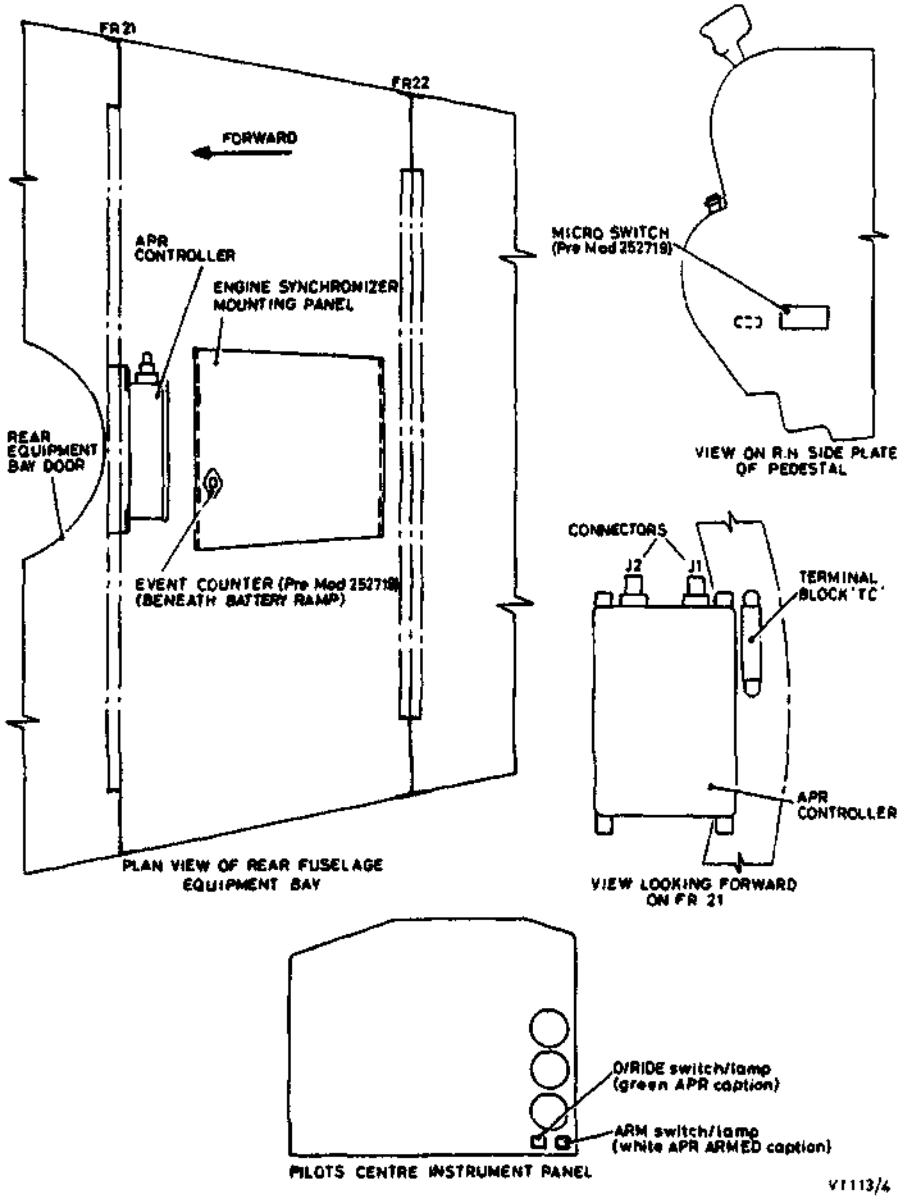
### B. Control switches

Two control switches, the Left one labelled APR O/RIDE and the Right one APR ARM are mounted on the pilots' center instrument panel.

The ARM switch has an APR ARMED, white caption which comes on when the switch is pushed to arm the system and goes out when the switch is pushed again to disarm the system.

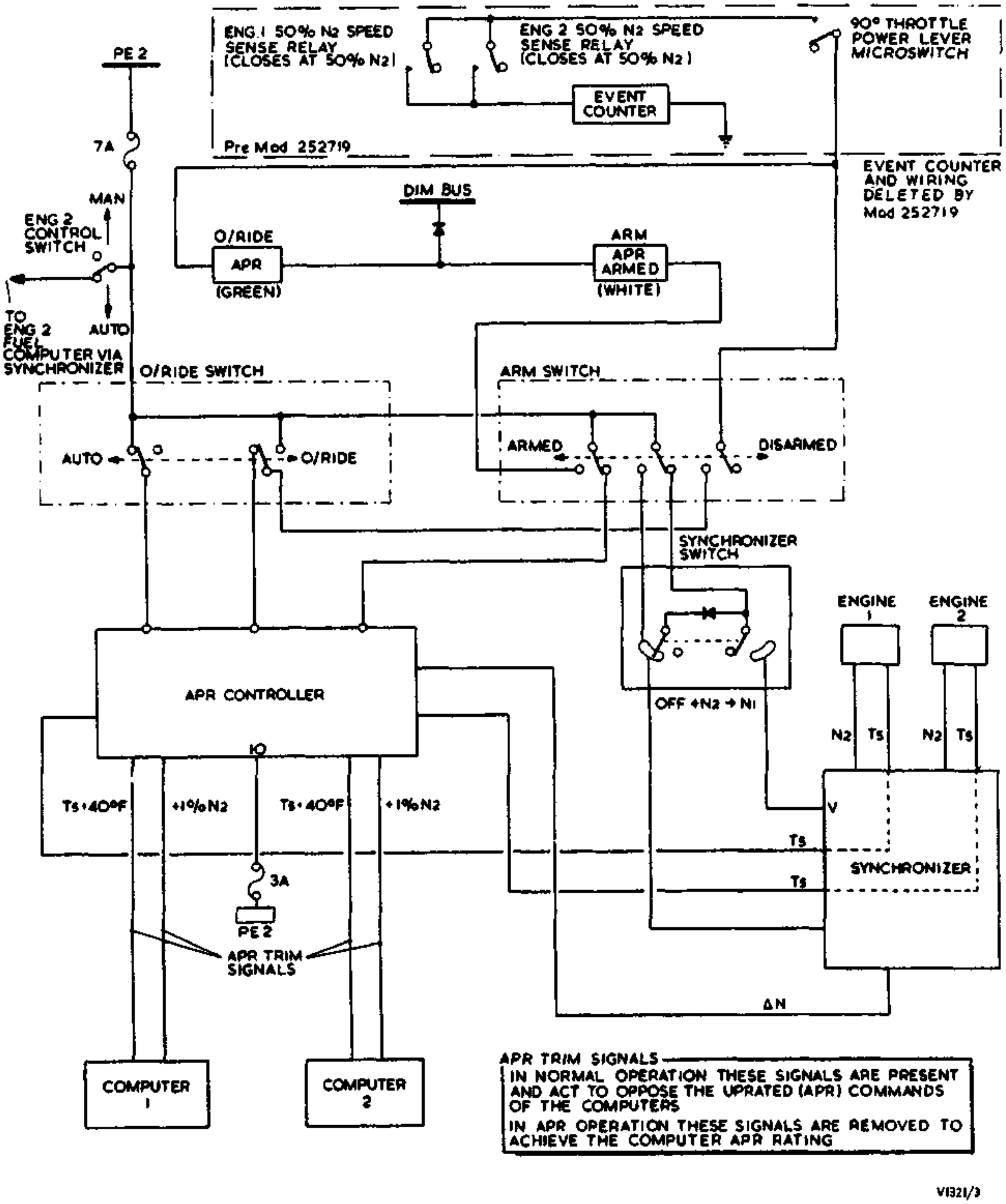
The O/RIDE switch has an APR green caption which comes on when the system is armed and triggered, either automatically by N2 difference or manually by pushing and latching the O/RIDE switch.

To cancel APR mode after manual selection, both the APR O/RIDE and APR ARM switches should be delatched. If only the APR ARM switch is delatched, APR will be cancelled but will be triggered again as soon as the APR ARM switch is pushed again.


FR 21
FR22
FORWARD
APR CONTROLLER
ENGINE SYNCHRONIZER MOUNTING PANEL
REAR EQUIPMENT BAY DOOR
EVENT COUNTER (Pre Mod 252719)
(BENEATH BATTERY RAMP)
PLAN VIEW OF REAR FUSELAGE EQUIPMENT BAY
MICRO SWITCH
(Pre Mod 252719)
VIEW ON R.H SIDE PLATE OF PEDESTAL
CONNECTORS
J2
J1
TERMINAL BLOCK 'TC'
APR CONTROLLER
VIEW LOOKING FORWARD ON FR 21
O/RIDE switch/lamp
(green APR caption)
ARM switch/lamp
(white APR ARMED caption)
PILOTS CENTRE INSTRUMENT PANEL
V1113/4

Typical details of APR system installation

*Figure 1*



APR TRIM SIGNALS
IN NORMAL OPERATION THESE SIGNALS ARE PRESENT AND ACT TO OPPOSE THE UPRATED (APR) COMMANDS OF THE COMPUTERS
IN APR OPERATION THESE SIGNALS ARE REMOVED TO ACHIEVE THE COMPUTER APR RATING

Schematic layout of APR system

*Figure 2*

### C. APR control unit

Both engine fuel computers limit maximum take-off power to the APR rating although under normal conditions, the APR control unit electrically trims down their setting to the lower normal rating. When APR is triggered the control unit allows the computers to reset to the APR rating. Normal engine response to the throttle movement is retained.

Failure of electrical power to the APR control unit will also result in both computers resetting to the APR rating.

### D. Event counter (Pre-Mod.252719)

A non-resetting APR EVENT counter is installed, and in order to minimize the automatic counting of insignificant events, its circuit is routed via the 50% N2 speed sense relay of either engine and the single microswitch related to an engine power lever setting of 90°, operated by either throttle lever.

### E. Synchronizer

The synchronizer must be serviceable to supply N2 comparison for the APR auto mode. Manual O/Ride is independent of N2 signals.

### F. Engine fuel computers

An engine fuel computer must be serviceable and selected to Auto in order to respond to APR.

Should an engine computer fail, or is selected to manual, with APR armed, APR will be triggered in the other engine if engine speed differences exceed 5% N2.

## 2. Operation *(Figure 2)*

### A. To arm system

(1) Make sure both switches are delatched and both captions are out.

(2) Push APR ARM switch and make sure APR ARMED caption only is on.

### B. To disarm system

(1) Make sure both switches are delatched and both captions are out.

(2) Push APR ARM switch and check APR ARMED caption only is on.

(3) Push APR ARM switch and make sure both captions are out.

### C. Automatic operation of system

(1) Arm system as in paragraph 2.A.

(2) When an N2 r.p.m. difference of more than 5% occurs between engines, the system will be triggered.

(3) Make sure APR ARMED white, and APR green captions are both on.

(4) Observe the change in engine performance and record any significant event (refer to paragraph 2.E.).

### D. Manual O/RIDE of system

(1) Arm system as in paragraph 2.A.

(2) *Push O/RIDE switch.*

(3) Make sure APR ARMED white, and APR green captions are both on.

(4) Observe the change in engine performance and record any significant event (refer to paragraph 2.E.).

### E. Recording "events"

APR operation above the nominal 907°C ITT or 100% N2 rev/min take-off limit increases engine stress and therefore such "events" are significant in that they:

(1) Reduce the life of certain engine components.

(2) Necessitate a "hot section" inspection after a specified number of events.

An APR event count may be applicable to one or both engines but does not necessarily represent an excursion above the normal take-off limitations.

*Events where the above limitations are exceeded (refer to Garrett AiResearch Service Bulletin* TFE731-72-3074) shall be recorded in the appropriate engine log book.

Details of engine inspections associated with the use of APR are detailed in the Aircraft Maintenance Schedule.

### F. Ground testing APR system

The system is ground tested in the automatic mode, with both engines idling. Details of ground testing and tables showing the minimum "Take-off Reference N1" speeds (with and without APR in operation) are given in the Maintenance Manual Chapter 71, POWER PLANT - GENERAL - Ground Running Tests.

# APR CONTROLLER REMOVAL/INSTALLATION

## 1. APR Controller

### A. Removal

(1) Open rear equipment bay door.

(2) Isolate the appropriate electrical circuit (refer to Table 401 and Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(3) Disconnect electrical connectors 'J1' and 'J2' from controller.

(4) Remove four hexagon head bolts to release unit from support plate. Retain bolts for further use.

### B. Installation

| Equipment/Material | Part/Item No. |
|---|---|
| Sealant | 314 (Chapter 20-95-301) |
| Cleaning agent | 204 or 230 (Chapter 20-95-201) |
| Aluminium wool | – |

(1) Examine unit for cleanliness, external damage and serviceability.

(2) Clean mating surfaces of controller mounting feet and the support plate with cleaning agent (item 204 or 230), until they are bright and clean.

(3) Locate unit on support plates, align holes in unit mounting feet with holes in plates. Attach by four hexagon head bolts and tighten to achieve resistance of 0.050 ohm or less.

(4) Apply sealant (Item 314) to seal bolt heads, nuts and along mating edges.

(5) Connect electrical connectors 'J1' and 'J2' to the controller.

(6) Restore the appropriate electrical circuit.

(7) Close the rear equipment bay door.

(8) Do a complete test to establish the integrity of the unit (Chapter 71-00-00, ADJUSTMENT/ TEST).

Table 401
APR CONTROLLER
POWER SUPPLY DETAILS

| Equipment | Supply | Panel | Fuse |
|---|---|---|---|
| APR controller | PE | ZK | F10 |
| | PE | ZK | F11 |
| | PE2 | ZK | F20 |
| | PE2 | ZK | F31 (Pre Mod.252747) |
| | PE | ZL | F4 (Mod.252747) |
| | PE | ZK | F32 (Pre Mod.252747) |
| | PE | ZL | F13 (Mod.252747) |

# APR EVENT COUNTER (Pre-Mod.252719) REMOVAL/INSTALLATION

## 1. APR Event Counter

### A. Removal

(1) Open rear equipment bay door.

(2) Record the counter reading.

(3) Isolate the appropriate electrical circuit, (refer to Table 401 and Chapter 24, ELECTRICAL POWER - *GENERAL for precautions).*

(4) Disconnect the electrical cables, TC2 and TC9 from terminal block 'T.C.' mounted below APR controller.

(5) Remove two mushroom head bolts and distance pieces to release the counter. Retain bolts and distance pieces.

*NOTE: Make sure that distance pieces are not lost within the fuselage.*

### B. Installation

(1) Examine counter for cleanliness, external damage and serviceability.

(2) Record the counter reading.

(3) Locate the counter on the synchroniser mounting, forward of the synchroniser unit. Make sure that the legend is visible when looking aft.

(4) Align attachment holes, interpose distance pieces between the counter base and mounting. Attach by two mushroom head bolts.

(5) Connect the electrical cables, TC2 and TC9 to terminal block 'TC' mounted below APR controller.

(6) Restore the appropriate electrical circuit.

(7) Close rear equipment bay door.

Table 401
EVENT COUNTER
POWER SUPPLY DETAILS

| Equipment | Supply | Panel | Fuse |
|---|---|---|---|
| Event counter | PE2 | ZK | F20<br>F32 |

# APR THROTTLE-ACTUATED MICROSWITCH (Pre-Mod.252719) MAINTENANCE PRACTICES

## 1. Removal/Installation

### A. Removal *(Figure 201)*

(1) Open rear equipment bay door.

(2) Isolate the appropriate electrical circuit (refer to Table 201 and Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(3) Remove throttle box right side cover to gain access to right side plate.

(4) Locate microswitch.

(5) Disconnect cables coded RC and RNO from terminals on lower side of microswitch. Suitably protect exposed cable ends.

(6) Loosen the two nuts attaching the microswitch mounting assembly to the back plate assembly, allowing switch roller to drop clear of cam lobe.

(7) Remove the two nuts securing the microswitch to the mounting assembly. Retain nuts for further use.

### B. Installation

(1) Locate anchor bolt shanks, protruding from microswitch mounting assembly, in holes in body of switch. Install and tighten nuts.

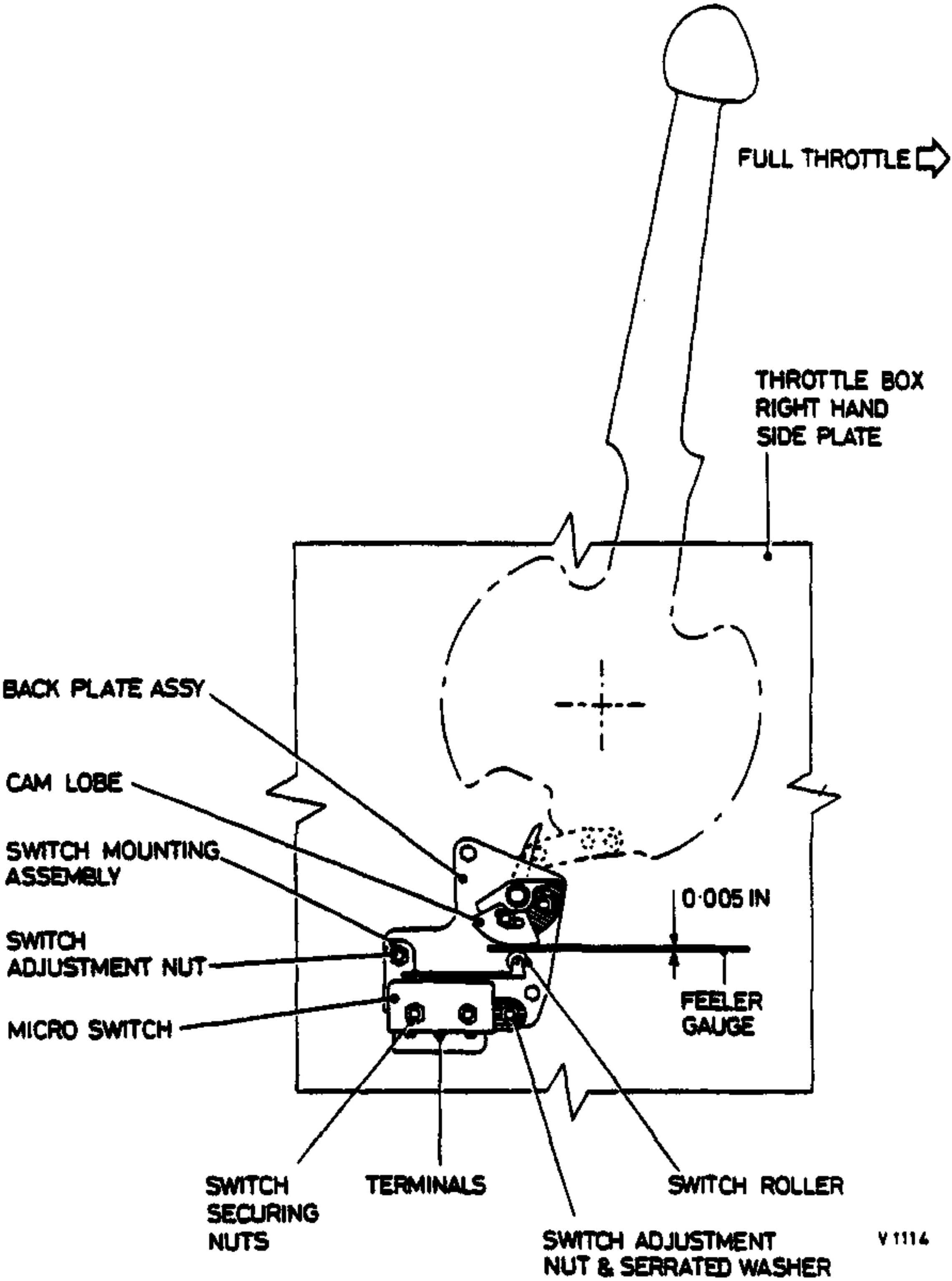
(2) Adjust microswitch, refer to paragraph 2. ADJUSTMENT/TEST.

(3) Remove protection from exposed ends and connect cables RC and RNO to the terminals on lower side of microswitch.

(4) Install the throttle box right side cover.

(5) Restore the appropriate electrical circuit.

(6) Close the rear equipment bay door.



APR system microswitch assembly details

*Figure 201*

## 2. Adjustment/Test

### A. Adjust microswitch *(Figure 201)*

| Equipment/Material | Part/Item No. |
|---|---|
| Lamp and battery test set | – |
| 0.005 in. feeler gauge | – |

*NOTE: Before adjusting microswitch make sure electrical circuit has been isolated (Table 201).*

(1) Fully open both throttles.

(2) With microswitch roller bearing on major diameter of cam, insert 0.005 in. feeler gauge between microswitch roller and cam.

(3) Adjust position of microswitch until it is just fully depressed and tighten microswitch securing nuts. Remove feeler gauge.

*NOTE: Do not overload microswitch. Adjustment of half a serration can be made by rotating serrated washer half a turn.*

(4) Connect the lamp and battery to terminals "NO" & "C" of microswitch.

(5) Fully close both throttles to 'idle' setting.

(6) Open right throttle until a reading of 90° is indicated by the "engine power lever scheduling indicator" of the right engine (No.2).

(7) Adjust radial position of cam until operation of microswitch is just indicated by illumination of lamp in test set. Lightly tighten cam securing nuts.

*NOTE: Adjustment of half a serration can be made by rotating serrated washer half a turn.*

(8) Fully close right engine (No.2) throttle to 'idle' setting.

(9) Open left engine (No.1) throttle until microswitch just operates, as indicated by test set lamp.

(10) Check the left (No.1) "engine power lever scheduling indicator", it should read less than 95°. Adjust cam if necessary.

(11) Tighten cam securing nuts.

(12) Remove test equipment.

**Table 201**
**APR THROTTLE-ACTUATED MICROSWITCH**
**POWER SUPPLY DETAILS**

| Equipment | Supply | Panel | Fuse |
|---|---|---|---|
| Microswitch RSD | PE | ZK | F32 |

# ENGINE FUEL AND CONTROL - INDICATING
# DESCRIPTION AND OPERATION

## 1. General *(Figure 1)*

Indication is given in the flight compartment of the following engine fuel parameters:

- Fuel flow
- Fuel consumed (special order only)
- Fuel low pressure
- Fuel overheat
- Fuel filter blockage
- Fuel computer off.

## 2. Fuel flow

The instantaneous rate of fuel flow to an engine is shown by an indicator operated by signals received from a rotary vane type transmitter installed in the main fuel supply line of each engine. The indicator is installed with integral lighting.

A fuel consumed indicator may be installed.

## 3. Fuel low pressure

Loss of fuel pressure, as sensed by a pressure switch at each engine fuel pump inlet, is indicated by a FUEL LOw PRESS annunciator on the master warning system (MWS) panel.

Each engine-mounted pressure switch is set at 6 to 7 psi. (0.41 to 0.48 bars).

## 4. Fuel overheat

Excessive fuel temperature, as sensed by a thermal switch in each engine fuel pump assembly, is indicated by a FUEL O HEAT annunciator on the MWS panel.

Each engine-mounted switch is set to operate at 87.8 + 2.8° C on a rising temperature. The switch de-actuates at 65.6° C on a falling temperature.

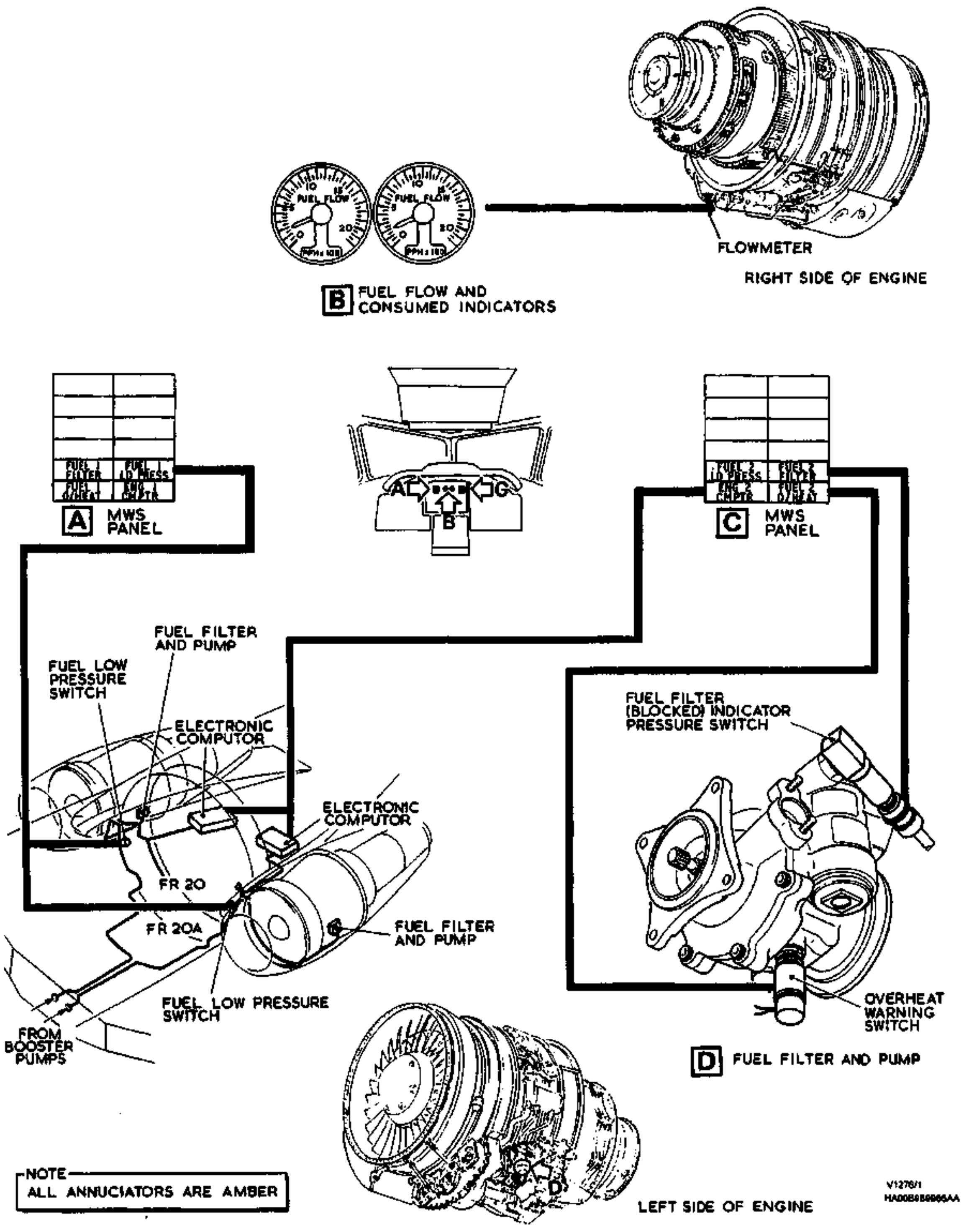
## 5. Fuel filter blocked

Blockage of a low pressure fuel filter, as sensed by a differential pressure switch housed in each fuel pump assembly, is indicated by a FUEL FILTER annunciator on the MWS panel. Each engine-mounted switch is set to operate between 6 to 8 psi. (0.41 to 0.55 bars) differential.

Whenever a filter is blocked a by-pass valve will open automatically to allow unfiltered fuel to flow to the engine fuel system.

## 6. Fuel computer off

Selection of either computer to manual or failure of electrical supplies to a computer is indicated by the ENG COMPTR annunciator on the MWS panel.



Fuel system indication

*Figure 1*

# ENGINE FUEL FLOW INDICATING SYSTEM DESCRIPTION AND OPERATION (Consolidated Airborne Systems)

## 1. General

The fuel flow indicating system comprises a fuel flow transmitter, in each engine fuel feed, which transmits signals to a signal conditioner and thence to a flow rate indicator, for each engine, and also (special order only) to a common fuel consumed indicator. The dial type flow rate indicators are calibrated in pounds per hour and the digital fuel consumed indicator is calibrated in pounds. The indicators are internally illuminated and mounted on the pilots center instrument panel.

Each engine is separately monitored on a continuous basis and only the fuel consumed indicator requires resetting to zero by depressing a mechanical reset on the indicator.

## 2. Flow transmitter

The transmitter, comprising a turbine type rotor - which is in the fuel flow path - and an accompanying pick-off - which generates the electrical output signals, is contained within a stainless steel housing with connections at both ends for connecting into the fuel system piping. Within the housing are straightening fins, both up-stream and downstream of the rotor, to dampen flow turbulence thus maintaining ideal laminar flow conditions. The rotor is a four bladed type, mounted in ball bearings, producing four signals per revolution. The signal pulse pick-off terminates in an electrical coupling for a loom connection.

## 3. Signal conditioner

This unit contains printed circuit boards housed in a metal container mounted in the equipment bay. It converts the a.c. output from the fuel flow transmitters to a d.c. signal supply to the indicators. Mounted on the container are electrical connectors for the looms.

## 4. Fuel flow indicators

The mechanism comprises a coil assembly mounted in jewel bearings, a magnet surrounded and shielded by a soft-iron frame, and miniature circuit boards all case-mounted. The dial is calibrated in pounds per hour and the display is internally illuminated.

## 5. Fuel consumed indicator

The indicator has a digital display of five digits and registers in pounds the total fuel consumed. A manual reset on the front of the indicator permits all digits to be returned to zero when required. The indicator is internally illuminated.

## 6. Power supplies

The 28v d.c. power supplies are from PS1 and PS2 busbars. The supply for the indicators illumination is from the 5v instrument lighting circuit.

# FLOWMETER TRANSMITTER - REMOVAL/INSTALLATION

## 1. Flowmeter Transmitter *(Figure 401)*

### A. Removal

(1) Close low pressure fuel cock.

(2) Remove appropriate fuse (refer to Table 401, and Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(3) Unlatch and stay open the cowling lower access door (Chapter 71, POWER PLANT - COWLINGS).

(4) Disconnect the engine harness from the fuel flowmeter transmitter.

(5) Disconnect the fuel pipe from the transmitter and seal off end of fuel pipe.

(6) Unscrew adapter nut from the transmitter and remove the transmitter. Discard the O-ring.

(7) Seal off adapter.

### B. Installation

(1) Make sure the fuel flowmeter transmitter is in a clean and undamaged condition.

(2) Install new O-ring to adapter.

(3) Remove the cap from adapter and screw transmitter to the adapter nut.

(4) Remove the cap from the fuel pipe and connect the pipe to the transmitter.

(5) Wire-lock nut attachments.

(6) Connect the engine electrical harness to the transmitter.

(7) Install appropriate fuse.

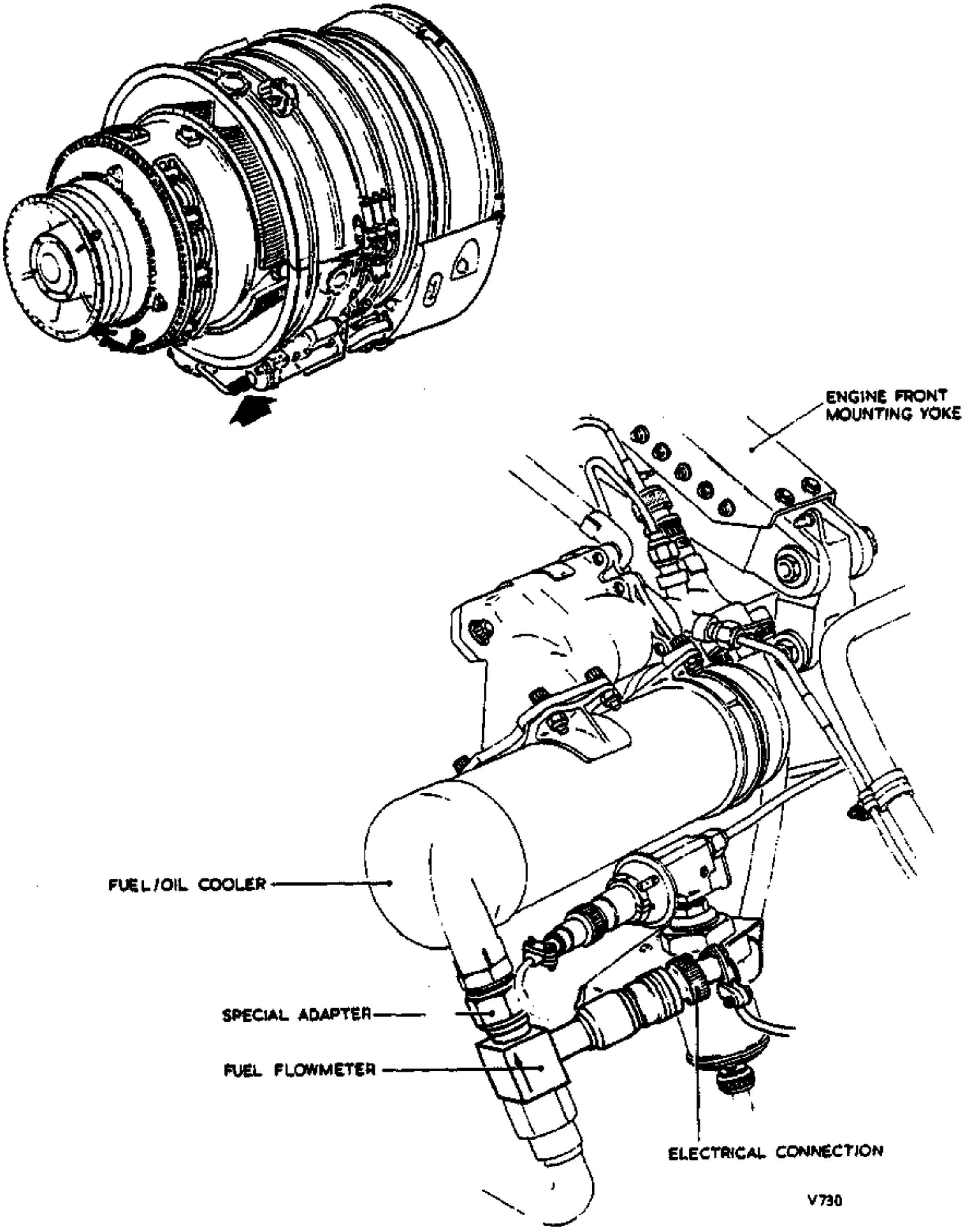
(8) Purge engine fuel system of air (Allied Signal, Light Maintenance Manual Report No.72-02-15, Chapter 72-00-00, GENERAL SERVICING).

(9) Run the engine (Chapter 71, POWER PLANT - GENERAL) and check the installation for fuel leaks and that the FUEL FLOW indicator registers satisfactorily.

(10) Stop engine and close lower access door.

Table 401
FLOWMETER TRANSMITTER
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | Fuse |
|---|---|---|---|---|
| Flowmeter transmitter | Left<br>Right | PS1<br>PS2 | ZK<br>ZK | F39<br>F48 |



Flowmeter transmitter

*Figure 401*

# SYSTEM SIGNAL CONDITIONER REMOVAL/INSTALLATION

## 1. System Signal Conditioner

### A. Removal

(1) Isolate electrical circuit to signal conditioner (refer to Table 401).

(2) Locate signal conditioner unit in rear equipment bay, identified aft of frame 21 as unit 'UE', and disconnect all electrical connectors.

(3) Remove the four bolts securing the signal conditioner to its panel and remove the unit.

### B. Installation

| Equipment/Material | Part/Item No. |
|---|---|
| Sealant | 314 (Chapter 20-95-301) |
| Cleaning agent | 204 or 230 (Chapter 20-95-201) |
| Aluminium wool | – |

(1) Examine unit for cleanliness, external damage and serviceability. All mating surface areas between the unit mounting channels and panel are to be bright and clean, using cleaning agent (item 204 or 230).

(2) Position unit on panel, align holes in mounting channel with those in panel. Attach by four hexagon head bolts and tighten to achieve resistance of 0.05 ohm or less.

(3) Apply sealant (Item 314) to bolt heads, nuts and along mating edges.

(4) Connect electrical connectors to unit.

(5) Restore electrical circuit.

(6) Do a test to establish the integrity of the unit (Chapter 71-00-00).

Table 401
SYSTEM SIGNAL CONDITIONER
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | Fuse |
|---|---|---|---|---|
| System signal conditioner | Left | PS1 | ZK | F39 |
| | Right | PS2 | ZK | F48 |
| | Supply to pin 'R' | PS1 | ZK | F38 |

# FUEL LOW-PRESSURE SWITCH - REMOVAL/INSTALLATION

## 1. Fuel Low-pressure Switch *(Figure 401)*

| Equipment/Material | Part/Item No. |
|---|---|
| Fuel container (5 gall. approx) | – |

### A. Removal

(1) Select the fuel feed system low pressure valve closed on the pilot's center control pedestal.

(2) Remove appropriate fuse, (refer to Table 401 and Chapter 24, GENERAL for precautions).

(3) Drain the fuel pipes downstream of the low pressure fuel valves through the rear fuselage drain (Chapter 28, FUEL - FUEL FEED SYSTEM (Main Engines)) into a clean container. Close the drain valve and wire-lock.

(4) Uncouple the electrical connection to the fuel low-pressure switch.

(5) Unscrew the low-pressure switch from the main fuel pipe gallery and discard the O-ring.

(6) Seal off the pressure switch boss on the main fuel pipe.

### B. Installation

(1) Make sure that the pressure switch is clean and undamaged.

(2) Install new O-ring and screw the low-pressure switch in main fuel pipe. Wire-lock the connection.

(3) Couple the electrical connection to the pressure switch.

(4) Install fuse.

(5) Open the low-pressure fuel valve.

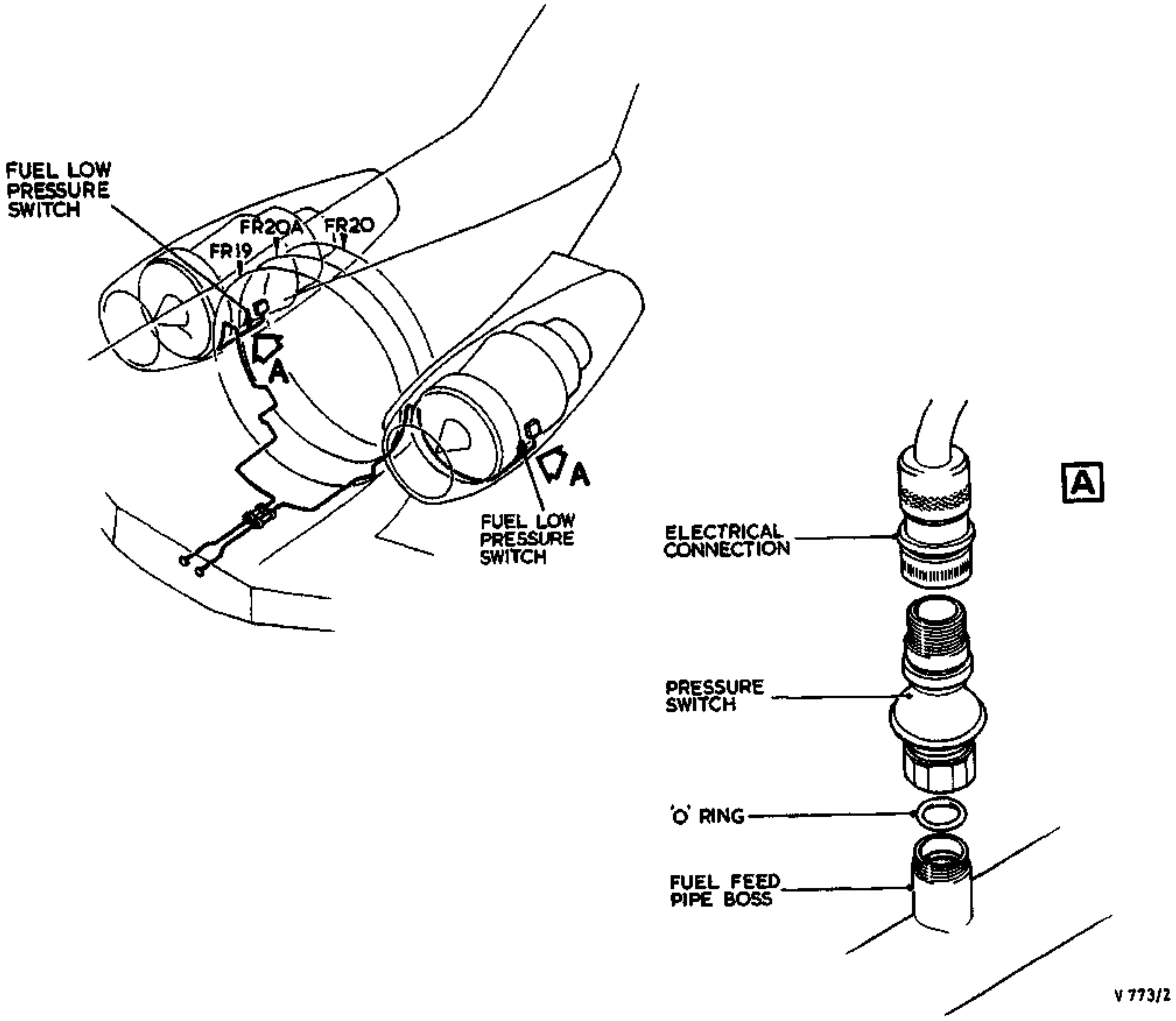
(6) Purge engine fuel system of air (Allied Signal, Light Maintenance Manual Report No. 72-02-15, Chapter 72-00-00, GENERAL SERVICING.

(7) Run the appropriate fuel booster pump and make sure that the amber ENG LO PRESS annunciator, on the pilot's roof panel, goes out.

(8) Switch off the booster pump.

Tagle 401
FUEL LOW PRESSURE SWITCH
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | Fuse |
|---|---|---|---|---|
| Fuel low pressure switch | Left<br>Right | PE<br>PE | ZL<br>ZL | F23<br>F24 |



Fuel low-pressure switch installation

*Figure 401*

# FUEL OVERHEAT WARNING SWITCH REMOVAL/INSTALLATION

## 1. Fuel Overheat Warning Switch *(Figure 401)*

| Equipment/Material | Part/Item No. |
|---|---|
| Insert/extract tool | M15570-16 (DHS 620 detail 241E) |

### A. Removal

(1) Close low pressure fuel cock.

(2) Remove appropriate fuse (refer to Table 401 and Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(3) Remove the power plant lower access door (Chapter 71, POWER PLANT - COWLINGS).

(4) Using the insert/extract tool disconnect the temperature switch in-line 'Jiffy' connections.

(5) Unscrew the fuel 'overheat' temperature switch from the engine fuel pump. Discard O-ring.

(6) Install cap to switch boss on the engine fuel pump.

### B. Installation

(1) Make sure that the fuel temperature switch is clean and undamaged.

(2) Install new O-ring to the switch.

(3) Screw the switch into the fuel pump. Tighten locknut and wire-lock.

(4) Connect the switch flying leads to the engine harness by 'Jiffy' in-line connector using insert/extract tool.

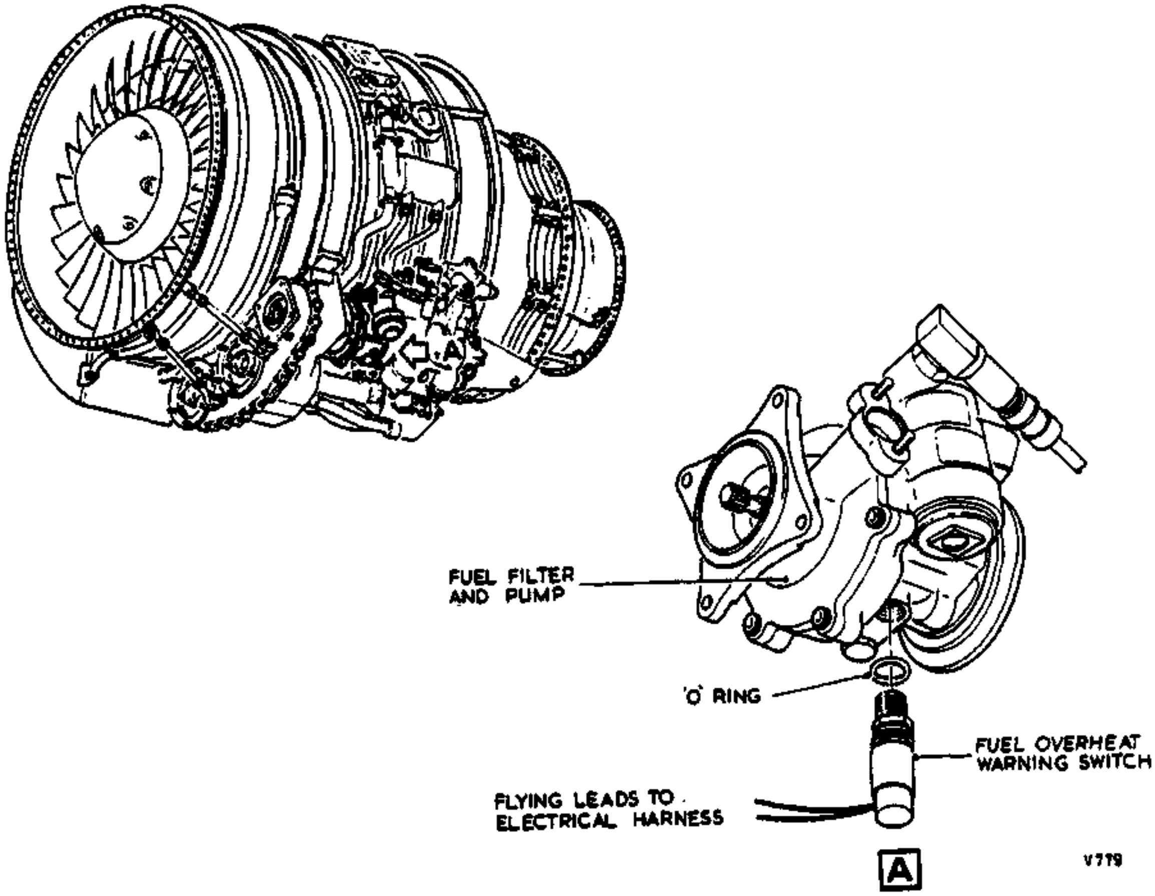
(5) Install appropriate fuse.

(6) Purge engine fuel system of air (Allied Signal, Light Maintenance Manual Report No. 72-02-15, Chapter 72-00-00, GENERAL SERVICING).

(7) Install the lower access door.

Table 401
FUEL OVERHEAT WARNING SWITCH
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | Fuse |
|---|---|---|---|---|
| Fuel overheat warning switch | Left<br>Right | PE<br>PE | ZL<br>ZL | F18<br>F19 |

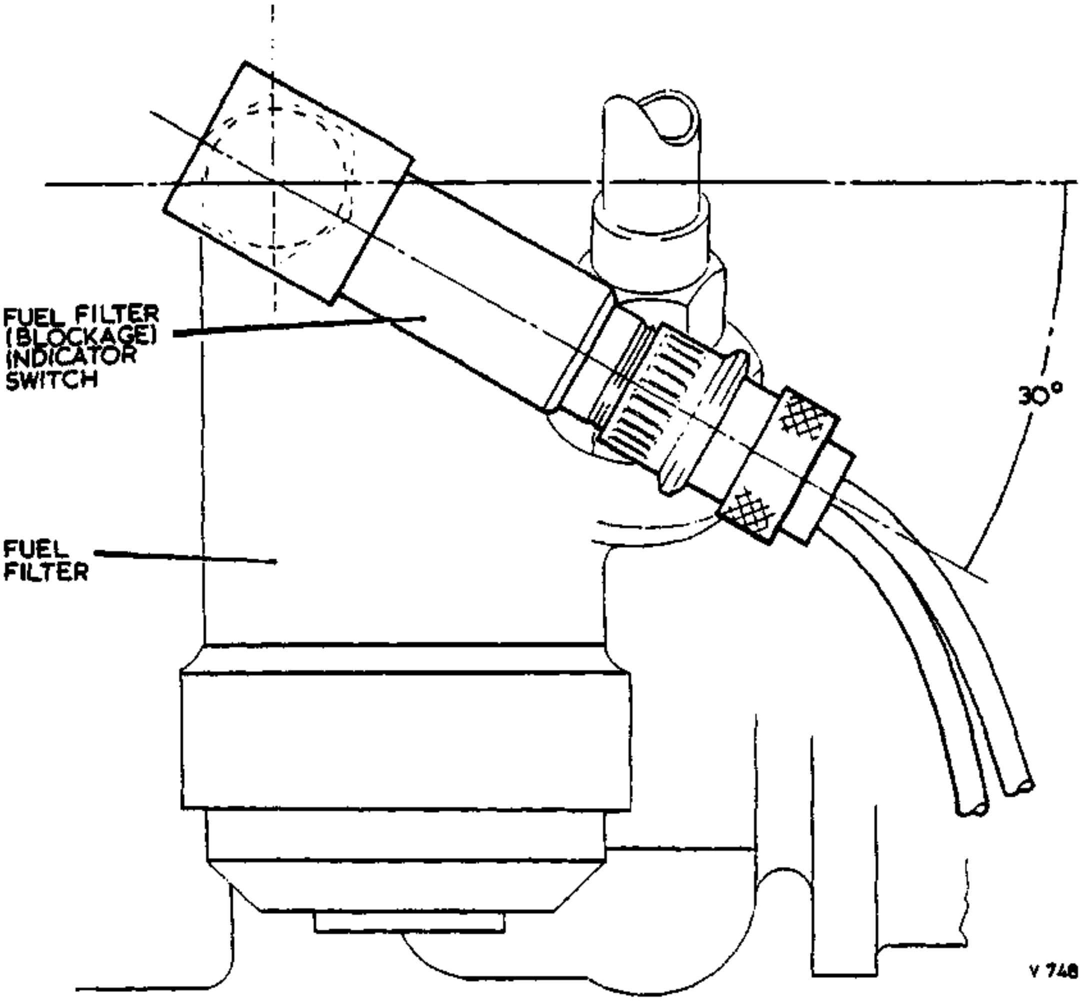

A
FUEL FILTER AND PUMP
'O' RING
FUEL OVERHEAT WARNING SWITCH
FLYING LEADS TO ELECTRICAL HARNESS
A
V779

Fuel overheat temperature switch
*Figure 401*

# FUEL FILTER (BLOCKAGE) INDICATOR SWITCH REMOVAL/INSTALLATION

## 1. Procedure

*NOTE: For the removal and installation of the fuel filter indicator switch, refer to the Allied Signal, Light Maintenance Manual Report No. 72-02-15. On installation, make sure that the fuel filter switch is set approximately to the angle given in Figure 401.*



Indicator switch installation angle

*Figure 401*

# CHAPTER

# 74

# IGNITION

# CHAPTER 74

# IGNITION

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| | 502 | Oct.99 | | | |

# IGNITION - SUB-ASSEMBLIES AND COMPONENTS REMOVAL/INSTALLATION

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF, AN ENGINE. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER SUCH COMPONENT IS REMOVED, IMMEDIATELY INSTALL A CAP TO THE APERTURE.**

*NOTE: Reference is made to the pertinent Removal/Installation procedure as detailed in the Allied Signal, Light Maintenance Manual, Report No.72-02-15.*

## 1. Procedure

### A. Sub-assemblies and components *(Refer to Allied Signal Light Maintenance Manual)*

| | |
|---|---|
| (1) Igniter unit, igniter plugs and igniter leads. | Chapter 74-00-01. |

### B. Access procedure

(1) Remove lower access door.

(a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot and turn lever outboard to release. Open access door.

(b) With the door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into each facia hole and lever outboard to release. Remove access door.

(2) Remove upper panel.

(a) At the aft edge of the panel, insert a suitable 0.25 in. rod into the facia hole of each shear pin latch and turn lever outboard to release.

(b) At the forward edge of the panel, remove the three countersunk screws securing the panel to the aft cowl assembly. Carefully remove upper panel making sure that its hinge bars (3) do not damage local electrical cables or looms.

(3) Isolate pertinent electrical supplies by removing fuses (refer to Table 401).

(4) Disconnect L.T. electrical supplies to the igniter unit.

(a) Locate the L.T. socket coded LJ (IGNITION UNIT), left engine or MJ (IGNITION UNIT), right engine.

(b) Carefully unscrew the socket and close the end using a plastic blanking cap.

### C. Adjustment/test

(1) Remove plastic sealing cap from socket.

(2) Reconnect L.T. socket coded LJ (IGNITION UNIT), left engine or MJ (IGNITION UNIT), right engine.

(3) Restore pertinent electrical supplies by installing fuses (refer to Table 401).

(4) Do at least one engine start - Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

**D. Close-up**

(1) Install upper panel.

(a) Locate the panel on the engine and make sure that its hinge bars do not damage local electrical cables or looms.

(b) Align bolt holes (3 off) at the forward edge of the panel and install securing bolts but do not tighten at this stage.

(c) Align the panel shear pins (2 off) with their assembly housings on the aft cowl assembly and close the shear pin latches and make sure they seat flush.

(d) Tighten panel securing bolts installed in paragraph (b).

(2) Install lower access door.

(a) Position the door up to the hinge bars on the upper panel. Close the hinge latches and make sure they seat flush.

(b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50% renew the seal (refer to Chapter 71-10-00, SERVICING).*

**Table 401 (Series F400)**
**ENGINES - POWER SUPPLIES**

| Circuit | | Sub-panel D - circuit breaker | Sub-panel E - circuit breaker | Panel ZK - fuse | Panel ZL - fuse |
|---|---|---|---|---|---|
| Fuel filter | Left | - | - | - | F16 |
| | Right | - | - | - | F17 |
| Fuel temperature | Left | - | - | - | F18 |
| | Right | - | - | - | F19 |
| Oil low pressure | Left | - | - | - | F21 |
| | Right | - | - | - | F22 |
| Oil temperature | Left | - | B21 | - | - |
| | Right | - | B22 | - | - |
| Oil pressure | Left | B15 | - | - | - |
| | Right | B16 | - | - | - |
| Fuel flowmeter | Left | - | - | F38, F39 | - |
| | Right | - | - | F38, F48 | - |
| Fire detection | Left | - | - | - | F12 |
| | Right | B22 | - | - | F11 |
| Eng/intake de-ice | Left | B50 | - | F24 | - |
| | Right | B51 | - | F25 | - |
| Engine r.p.m. | Left | - | - | F34, F35, F44, F45 | - |
| | Right | - | - | F29, F30, F54, F55 | - |
| I.T.T. | Left | - | - | F28 | - |
| | Right | - | - | F28 | - |
| No.1 fuel computer | | - | - | F10, F31 | - |
| No.2 fuel computer | | - | - | F11, F20, F32 | - |
| Ignition | Left | - | - | - | F5 |
| | Right | - | - | - | F6 |

# IGNITION MICROSWITCH ADJUSTMENT/TEST

## 1. Ignition Microswitch - Adjustment *(Figure 501)*

| Equipment/Materials | Part/Item No. |
|---|---|
| Lamp and battery | - |
| Sealant | Item 372 (Chapter 20-95-301) |

### A. Procedure

(1) Disconnect power supplies to microswitch (refer to Table 501 and Chapter 24 GENERAL for precautions).

(2) Gain access to the center control pedestal by removing left and right side panels

(3) Move the relevent high pressure fuel cock (HPC) lever from OFF until the cam on the cable drum is central to the microswitch operating roller.

(4) Disconnect and remove the cable guard.

(5) Lightly slacken the microswitch mounting bolt and rotate the microswitch away from the cam.

(6) Connect a slave lamp and battery across appropriate terminals of supply terminal block RR (refer to Table 501)

(7) Rotate the microswitch until its operating roller comes into contact with the cam then continue rotation until the slave lamp comes on.

(8) Maintain the switch setting and measure dimension 'X' by using feeler gauges.

(9) Further rotate the microswitch to reduce dimension 'X' by 0.005 inches, maintain this setting and tighten the microswitch mounting bolts.

(10) Move the HPC lever to its ungated fully ON position and check that the slave lamp remains on.

(11) Return the HPC lever to OFF.

(12) Apply sealant (Item 372) to the switch mounting bolts threads and nuts.

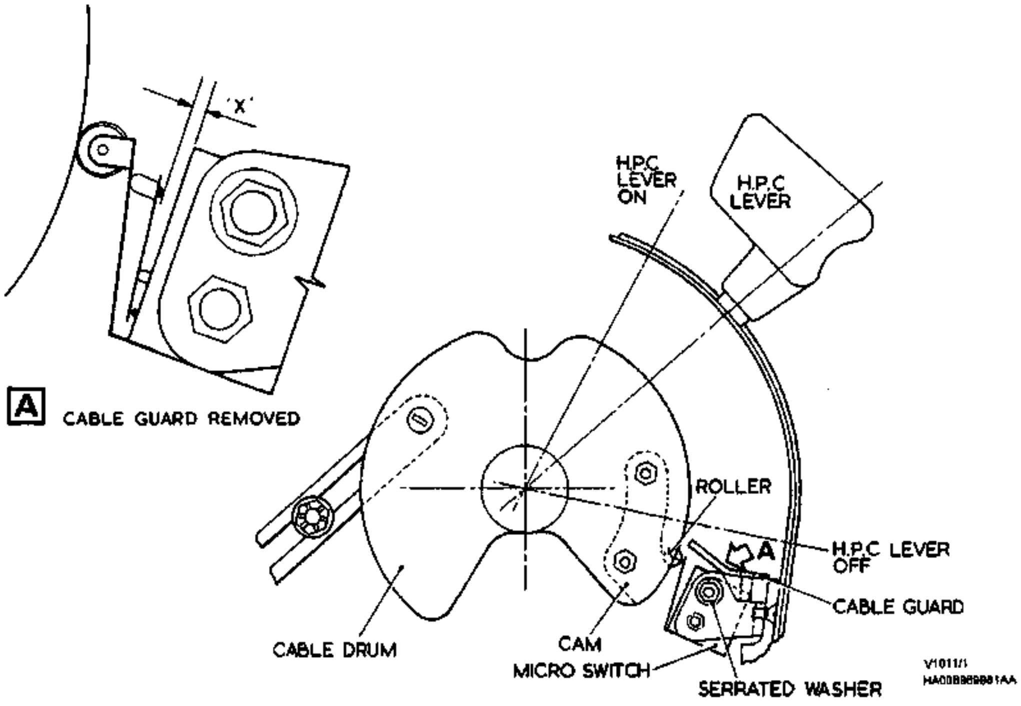
(13) Disconnect and remove the lamp.

(14) Install side panels to the central control pedestal.

(15) Close circuit breakers to engine ignition system.

*Table 501*
IGNITION MICROSWITCH-POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | C/B | T/B Pedestal | Ident |
|---|---|---|---|---|---|---|
| Ignition microswitch | (LH) | PE | ZK | B2 | RR | 5R-6R |
| | (RH) | | | | RR | 6R-9L |



Ignition microswitch adjustment
*Figure 501*

# CHAPTER

# 75

# AIR

# CHAPTER 75

# AIR

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# AIR
# GENERAL

## 1. Air bleeds - General

Air is bled from two stages of the engine compressor to provide supplies for:

(1) Engine anti-icing:

Fan spinner (Pre-Garrett AiResearch SB.72-3085 and Mod.252718).

*NOTE: Garrett AiResearch SB.72-3085 and Mod.252718 delete the anti-icing facility. Mod.258327 restores the anti-icing facility if required.*

Nacelle inlet cowl.

(2) Aircraft services:

Air conditioning and pressurization (Chapter 21, AIR CONDITIONING), Rudder Bias System (Chapter 27, FLIGHT CONTROLS).

## 2. Location of anti-icing controls and indicators

The location of controls and indicators is shown in *Figure 2.*

## 3. Engine anti-icing

### A. General

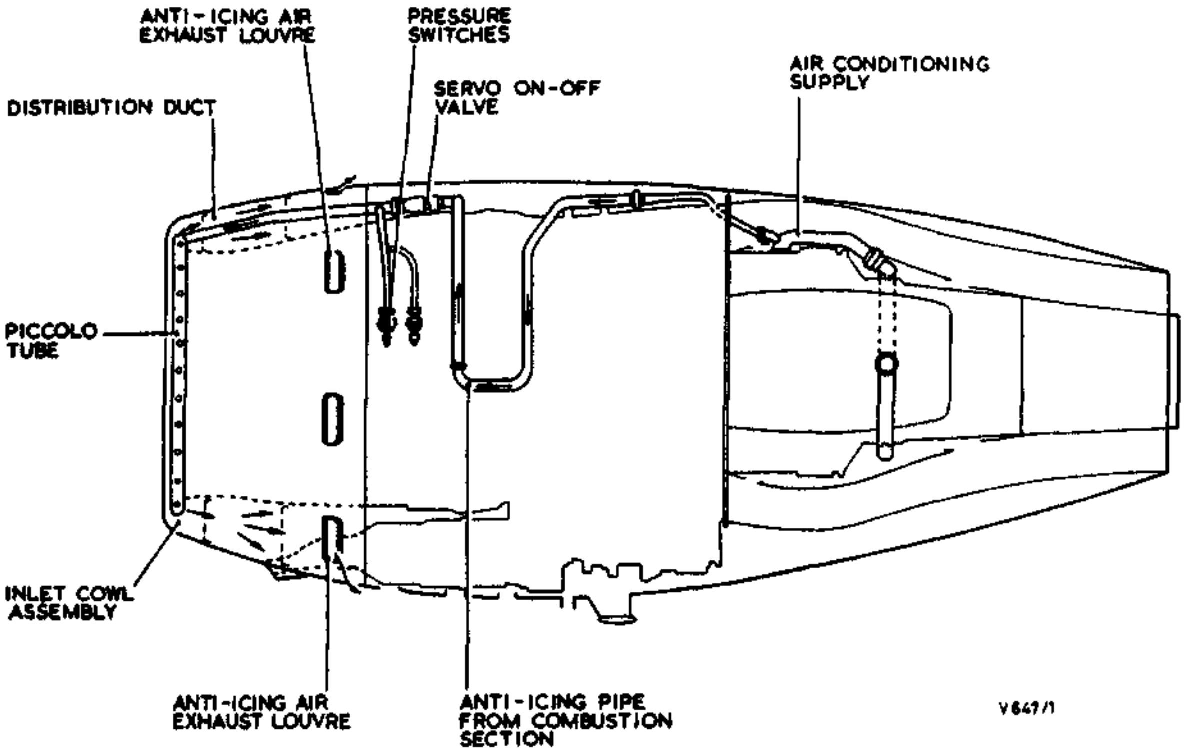
Engine anti-icing comprises two separate systems for each engine, fan spinner anti-icing (Pre-Garrett AiResearch SB.72-3085 and Mod.252718) and nacelle inlet cowl anti-icing. Selection of both systems is by a common switch. Post-Mod.252718 and Garrett AiResearch SB.72-3085, the switch controls nacelle inlet cowl anti-icing only.

### B. Fan spinner anti-icing (Pre-Garrett AiResearch SB.72-3085 and Mod.252718 only)

The fan spinner is anti-iced by high pressure compressor air bled from the combustion chamber plenum, controlled by a solenoid-operated pneumatic shut off valve. A PcD pressure switch forms part of the indicating system.

### C. Nacelle inlet cowl anti-icing *(Figure 1)*

High pressure air is bled from the engine combustion chamber and ducted forward to anti-ice the nacelle inlet cowl. The air flow is controlled by a solenoid-operated servo valve. Two pressure switches form part of the indicating system. One pressure switch, set at 6 psi is in circuit during ground operation. The other pressure switch, set at 20 psi, is in circuit during airborne operation. On take-off, the lever-lock microswitch on the left main landing gear leg transfers the indicating source from the 6 psi to the 20 psi switch to cater for the higher pressure required to meet all bleed air demands.



*Nacelle inlet cowl anti-icing*
*Figure 1*

### D. Selection and indication

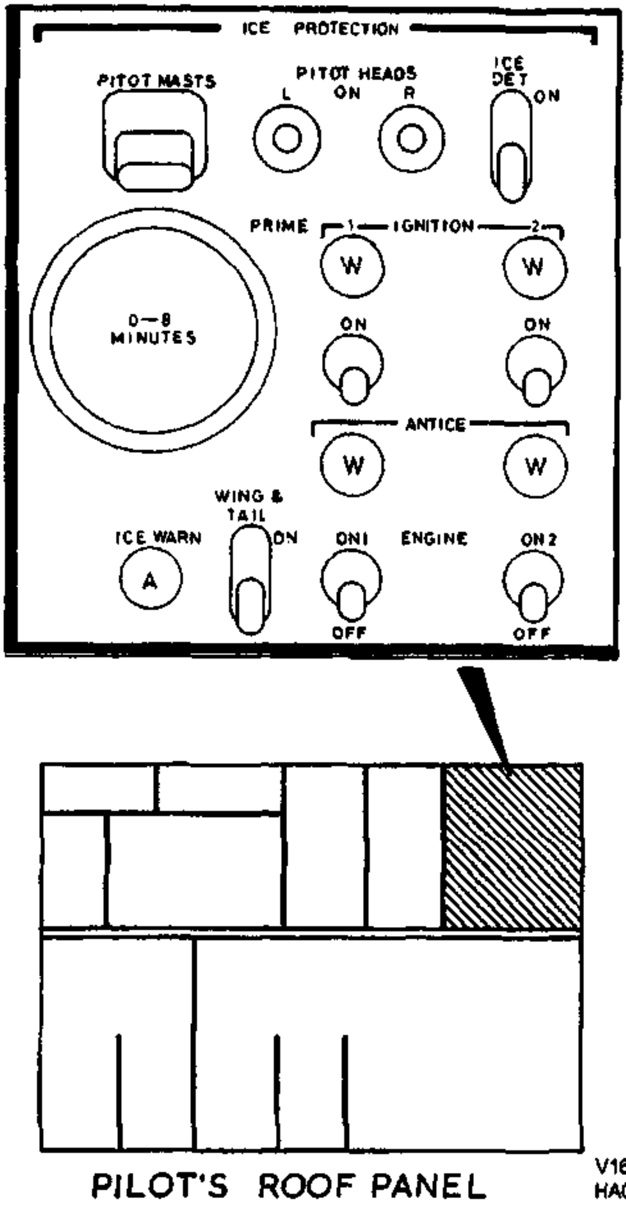
When an engine antice 'on' selection is made, electrical power is connected to the control valve of the nacelle inlet cowl system and, Pre-Garrett AiResearch SB.72-3085 and Mod.252718, the fan spinner system control valve. When the respective valves open, system pressure increases, the PcD pressure switch (Pre-Mod.252718) and the nacelle inlet cowl pressure switches close when their pre-set operating pressures are reached.

The nacelle pressure switches and, Pre-Mod.252718, the fan spinner PcD pressure switch are wired in series so that, when they are made, the appropriate engine antice 'on' indication is lit.

Post-Mod.252718, the supply socket is disconnected from the PcD switch and continuity with the nacelle pressure switches is achieved by connecting socket pins A and B with a shorting plug. Thus any engine antice 'on' indication comes only from the nacelle switches.

## 4. Electrical power supplies

The d.c. electrical power supplies for the engine anti-icing systems are taken from the PE busbar.



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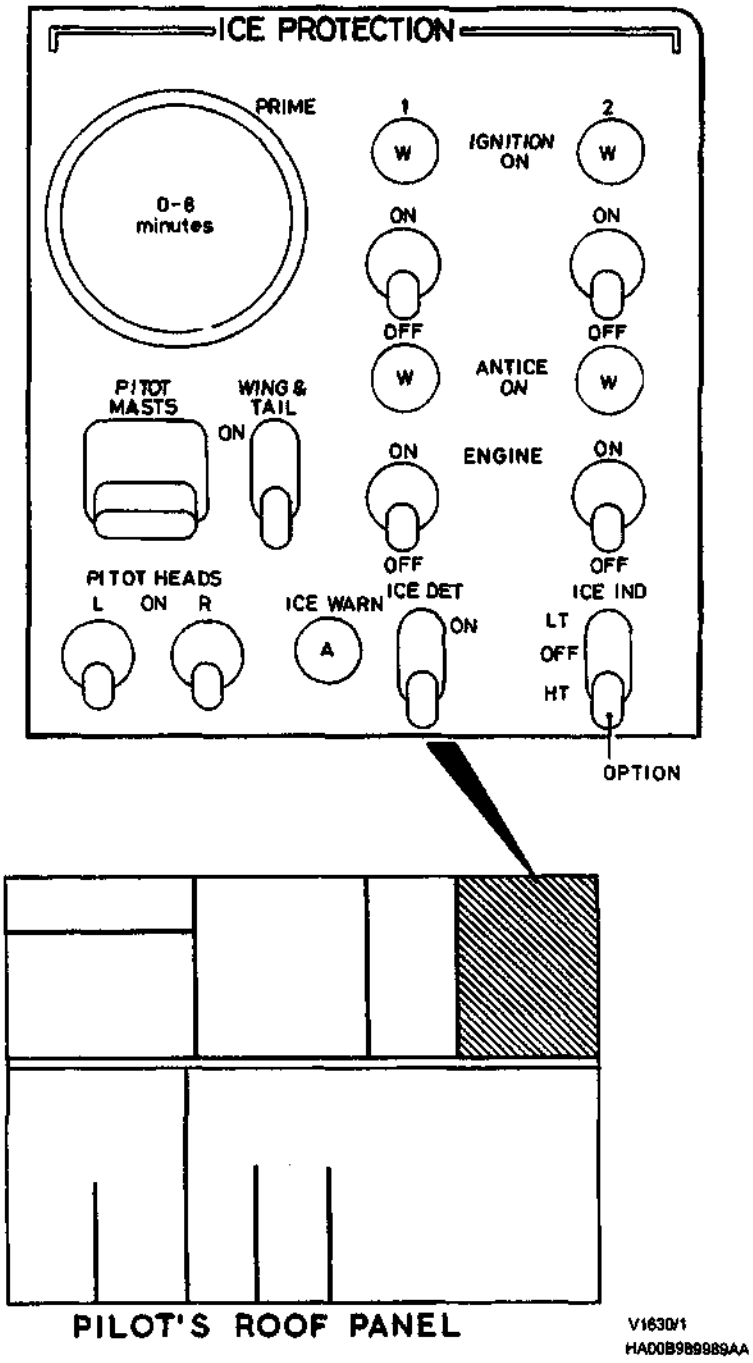
Location of controls and indicators
*Figure 2 - Sheet 1*



Location of controls and indicators

*Figure 2 - Sheet 2*

# AIR
# SERVICING

## 1. Delete/restore engine air intake spinner anti-icing (Mod.252718/258327)

NOTE: *Garrett AiResearch SB.72-3085 introduces TFE731-3-1H or 731-3R-1H engines incorporating a conical spinner. This spinner does not require an anti-icing facility. Mod.252718 renders the anti-icing facility inoperative for conical spinner engines and Mod.258327 restores the facility should a replacement engine be supplied to Pre-Garrett AiResearch SB.72-3085 standard.*

Materials for Mod.252718

Hellermann plastic sleeving or
3M fibreglass adhesive tape 1.0 in. wide
Wire MS20995-C20 or equivalent.

Materials for Mod.258327

Nil.

Parts required for Mod.252718

NOTE: *The parts are supplied as a Mod Kit comprising:*

| Nomenclature | Part No. | Qty. per engine |
|---|---|---|
| Shorting plug | 25NF/Z1413/1A | 1 |
| P-clip | AS5418/14 | 1 |
| Bolt | A102 1/2D | 1 |
| Nut | H10-3 | 1 |

Parts required for Mod.258327

Nil.

### A. General

(1) When an engine incorporating a conical spinner is installed Mod.252718 must be embodied.

(2) Flight with a conical spinner engine on one side and a domed spinner engine is permitted provided that the conical spinner engine and its associated control system is to Mod.252718 standard and the other engine and control system is to Mod.258327 standard.

(3) Modification 252718 is embodied in two parts, viz:

Part A - Left engine - To render spinner anti-icing inoperative.

Part B - Right engine - To render spinner anti-icing inoperative.

(4) Modification 258327 to embodied in two parts:

Part A - Left engine - To restore spinner anti-icing.

Part B - Right engine - To restore spinner anti-icing.

**B. Embody Mod.252718 - Part A or B**

(1) Remove engine lower access door - refer to Chapter 71-10-00, COWLINGS - REMOVAL/ INSTALLATION.

(2) Immobilise PcD pressure switch:

(a) Remove fuse (refer to Table 301).

(b) Disconnect electrical power supply connector from pressure switch coded LM (Part A) or MM (Part B).

(c) Connect shorting plug (refer to Parts required) to connector removed in paragraph (b); tighten and wire-lock.

(d) Stow connector at the pre-drilled bottom hole in the engine casing flange aft of the ANTI-ICE SOLENOID VALVE coded LD (Part A) or MD (Part B) using a P-clip, bolt and nut (refer to Parts required).

(e) Re-install fuse (refer to Table 301).

(3) Disconnect and insulate cable at roof panel CG :-

(a) Open ANTI-ICE SOLENOID VALVE circuit breaker (refer to Table 301).

(b) Disconnect lead from terminal 4 of the ENG ANTICE 1 or 2 ON - OFF switch coded AR (Part A) or AS (Part B).

(c) Insulate the tagged or bared end of lead using a suitable length of sleeving (refer to Materials) and fold the sleeving back on itself and tape up (refer to Materials). Stow lead adjacent to switch AR (Part A) or AS (Part B).

*NOTE: If suitable sleeving is not available on site, tape up and stow cable. Make entry in Technical Log for the correct method of insulating to be effected on return to base.*

(d) Close circuit breaker (refer to Table 301).

(e) Ground test engine to check engine anti-icing system function - refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

(f) Install engine lower access door - refer to Chapter 71-10-00, COWLINGS - REMOVAL/ INSTALLATION.

**C. Delete Mod.252718 Part A or B by embodying Mod.258327**

(1) Remove engine lower access door - refer to Chapter 71-10-00, COWLINGS - REMOVAL/ INSTALLATION.

(2) Re-activate PcD pressure switch:

(a) Remove fuse (refer to Table 301).

(b) Remove connector complete with shorting plug from its stowage, retain attaching hardware for possible future use.

(c) Sever locking wire, unscrew shorting plug from connector; retain shorting plug for possible future use.

*NOTE: The shorting plug and its stowage hardware should be bagged and carried on the aircraft so that the parts are immediately available for possible future use in the event of an unscheduled engine change away from base.*

(d) Connect the connector to pressure switch coded LM (Part A) or MM (Part B).

(e) Re-install fuse (refer to Table 301).

(3) Connect lead at roof panel CG:-

(a) Open ANTI-ICE SOLENOID VALVE circuit breaker (refer to Table 301).

(b) Extract lead from its stowage and remove insulation.

(c) Connect lead to terminal 4 of the ENG ANTICE 1 or 2 ON - OFF switch coded AR (Part A) or AS (Part B).

(d) Close circuit breaker (refer to Table 301).

(e) Ground test engine and check engine anti-ice system - refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

(f) Install and close engine lower access door - refer to Chapter 71-10-00, COWLINGS - REMOVAL/INSTALLATION.

(g) Adjust Aircraft Log Book to reflect deletion of Mod.252718 Part A and/or Part B.

**Table 301**
**PcD PRESSURE SWITCH (PRE-MOD.252718) AND ANTI-ICE SOLENOID VALVE POWER SUPPLY DETAILS**

| Equipment | Engine | Supply | Panel | Fuse | C/B |
|---|---|---|---|---|---|
| PcD pressure switch | (Left)<br>(Right) | PE<br>PE | ZK<br>ZK | F24<br>F25 | –<br>– |
| Anti-ice solenoid valve | (Left)<br>(Right) | PE<br>PE | D<br>D | –<br>– | B50<br>B51 |

# AIR
# SUB-ASSEMBLIES AND COMPONENTS
# REMOVAL/INSTALLATION

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF, AN ENGINE. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER SUCH COMPONENT IS REMOVED, IMMEDIATELY INSTALL A CAP TO THE APERTURE.**

*NOTE: The procedure required to gain access to Allied Signal engine sub-assemblies and components, to permit their removal from an installed power plant is given below. Reference is also made to the pertinent Removal/Installation procedure as detailed in the Allied Signal, Light Maintenance Manual, Report No. 72-02-15.*

## 1. Procedure

### A. Sub-assemblies and components *(Refer to Allied Signal, Light Maintenance Manual)*

| | |
|---|---|
| (1) Anti-ice air pressure switch | Chapter 75-10-01. |
| (2) PT2 sensor | Chapter 75-40-01. |

### B. Access procedure

(1) Remove lower access door.

  (a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot and turn lever outboard to release. Open the access door.

  (b) With the door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into each facia hole and lever outboard to release. Remove access door.

(2) Remove upper panel.

  (a) At the aft edge of the panel, insert a suitable 0.25 in. diameter rod into the facia hole of each shear pin latch. Turn lever outboard to release.

  (b) At the forward edge of the panel, remove the three countersunk screws securing the panel to the aft cowl assembly. Carefully remove the panel making sure that its hinge bars (3) do not damage local electrical cables or looms.

(3) Isolate pertinent electrical supplies by removing fuses and/or opening circuit breakers (refer to Table 401).

### C. Close up

(1) Install upper panel.

(a) Locate the panel on the engine and make sure that its hinge bars do not damage local electrical cables or looms.

(b) Align the bolt holes (3 off) at the forward-edge of the panel and install securing bolts but do not tighten at this stage.

(c) Align the panel shear pins (2 off) with their assembly housings on the aft cowl assembly and close the shear pin latches and make sure they seat flush.

(d) Tighten the panel securing bolts installed in paragraph (b).

(2) Install the lower access door.

(a) Position the door up to the hinge bars on the upper panel. Close the hinge latches and make sure they seat flush.

(b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50% renew the seal (refer to Chapter 71-10-00, SERVICING).*

(3) Restore electrical supplies by installing fuses and/or closing circuit breakers (refer to Table 401).

### D. Adjustment/Test

*NOTE:* Ground test the engine - refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

### Table 401 (Series F400)
### ENGINES - POWER SUPPLIES

| Circuit | | Sub-panel D - circuit breaker | Sub-panel E - circuit breaker | Panel ZK - fuse | Panel ZL - fuse |
|---|---|---|---|---|---|
| Fuel filter | Left | - | - | - | F16 |
| | Right | - | - | - | F17 |
| Fuel temperature | Left | - | - | - | F18 |
| | Right | - | - | - | F19 |
| Oil low pressure | Left | - | - | - | F21 |
| | Right | - | - | - | F22 |
| Oil temperature | Left | - | B21 | - | - |
| | Right | - | B22 | - | - |
| Oil pressure | Left | B15 | - | - | - |
| | Right | B16 | - | - | - |
| Fuel flowmeter | Left | - | - | F38, F39 | - |
| | Right | - | - | F38, F48 | - |
| Fire detection | Left | - | - | - | F12 |
| | Right | B22 | - | - | F11 |
| Engine/intake de-ice | Left | B50 | - | F24 | - |
| | Right | B51 | - | F25 | - |
| Engine r.p.m. | Left | - | - | F34, F35, F44, F45 | - |
| | Right | - | - | F29, F30, F54, F55 | - |
| I.T.T. | Left | - | - | F28 | - |
| | Right | - | - | F28 | - |
| Ignition | Left | - | - | - | F5 |
| | Right | - | - | - | F6 |
| No.1 fuel computer | | - | - | F10, F31 | - |
| No.2 fuel computer | | - | - | F11, F20, F32 | - |

# NACELLE INLET COWL ANTI-ICING SERVO ON-OFF VALVE REMOVAL/INSTALLATION

## 1. Anti-icing servo on-off valve

| Equipment/Material | Part/Item No. |
|---|---|
| Torque wrench | Capable of 35-45 lbf/in. |

### A. Removal

(1) Open appropriate engine anti-icing circuit breaker, Table 401 (Chapter 24, ELECTRICAL POWER - GENERAL for Precautions).

(2) Remove the power plant lower access door and upper cowl panel.

(3) Disconnect the electrical harness from the servo on-off valve solenoid.

(4) Break the locking wire and unscrew the pinch bolt of the V-clamp at the duct joint either side of the valve.

(5) Remove the valve from the duct.

### B. Installation

(1) Make sure that the valve is clean internally and insert in the inlet cowl anti-icing duct. Make sure that the direction of flow arrow on the valve is pointing forward.

(2) Install the V-clamp to the duct/valve joint either side of the valve.

(3) Torque tighten the V-clamp bolt to 35 to 45 lbf/in. and wire lock.

(4) Connect the electrical harness to the valve solenoid.

(5) Close relevant circuit breaker.

(6) With power supplies available (Chapter 24, ELECTRICAL POWER - GENERAL) test operation of the valve:

  (a) Select appropriate engine antice switch on roof panel to ON and check that relevant warning lights comes on.

  (b) Select switch to OFF and make sure that warning light goes out.

(7) Ground run the engine (Chapter 71, POWER PLANT - GENERAL) and examine the engine anti-icing system duct joints for leaks.

(8) Stop engine.

(9) Install power plant upper cowl panel and lower access door.

Table 401
NACELLE INLET COWL ANTI-ICING SERVO ON-OFF VALVE
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | CB Ident | Grid ref. |
|---|---|---|---|---|---|
| On-Off solenoid valve | Left<br>Right | PE<br>PE | D<br>D | ENG 1 ANTICE<br>ENG 2 ANTICE | D11<br>D12 |

# NACELLE INLET COWL ANTI-ICING PRESSURE SWITCHES REMOVAL/INSTALLATION

## 1. Anti-icing Pressure Switches

### A. Removal

(1) Remove the engine lower access door and upper cowl panel.

(2) Remove appropriate fuse, Table 401. Refer to Chapter 24, ELECTRICAL POWER - GENERAL for precautions.

(3) Disconnect the electrical harness connection to the pressure switch.

*NOTE: Front switch operates at 6 psi, rear at 20 psi.*

(4) Disconnect the pneumatic pipe from the pressure switch.

(5) Unscrew and remove nut and washer securing the pressure switch to its mounting bracket.

(6) Remove the pressure switch from the mounting bracket.

### B. Installation

(1) Insert the pressure switch through the underside of the mounting bracket and secure to the bracket with washer and nut.

(2) Connect the pneumatic supply pipe to the switch.

(3) Connect the engine harness to the pressure switch.

(4) Install appropriate fuse.

(5) Ground run the engine (Chapter 71, POWER PLANT - GENERAL) and with the engine antice switch ON, check the relevant warning lights.

(6) Switch off engine anti-icing and stop engine.

Table 401
NACELLE INLET COWL ANTI-ICING PRESSURE SWITCHES
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | Fuse |
|---|---|---|---|---|
| Pressure switch | Left<br>Right | PE<br>PE | ZK<br>ZK | F24<br>F25 |

# CHAPTER

# 76

# ENGINE CONTROLS

# CHAPTER 76

# ENGINE CONTROLS

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# POWER CONTROLS
# DESCRIPTION AND OPERATION

## 1. General *(Figure 1)*

The engine power controls are grouped on the pilots' control pedestal and comprise a throttle lever and a high pressure fuel cock lever for each engine. Control cables connect each throttle and high pressure fuel cock lever to an engine control assembly mounted inside the rear fuselage adjacent to the respective engine pylon. From each engine control assembly a single operating rod, routed outboard into the pylon connects with a linkage incorporating a telescopic link. The aft end of the telescopic link is universally pivoted to absorb and accommodate the radial throw of its operating lever. The output end of the telescopic link is connected by Teleflex control, to a lever which rotates a power shaft in a fuel control unit on the engine.

Initial rotation of the power shaft provides the high pressure fuel cock function and continued rotation by application of the throttle lever progressively increases the fuel flow from 'idling' to 'full' power.

An interconnecting link between the high pressure fuel cock and throttle lever makes sure that, with the throttle lever set at 'full' power, selection of the high pressure fuel cock lever from ON to OFF automatically moves the throttle lever back to its 'idle' stop.

Control cables from the pedestal levers are routed aft on pulleys beneath the cabin floor then up the rear pressure dome to the respective cable drums in the engine control assemblies.

*NOTE: For examination and rejection criteria on control cables (refer to Chapter 20, STANDARD PRACTICES - CONTROL CABLES - EXAMINATION AND REJECTION CRITERIA).*

## 2. Throttle control

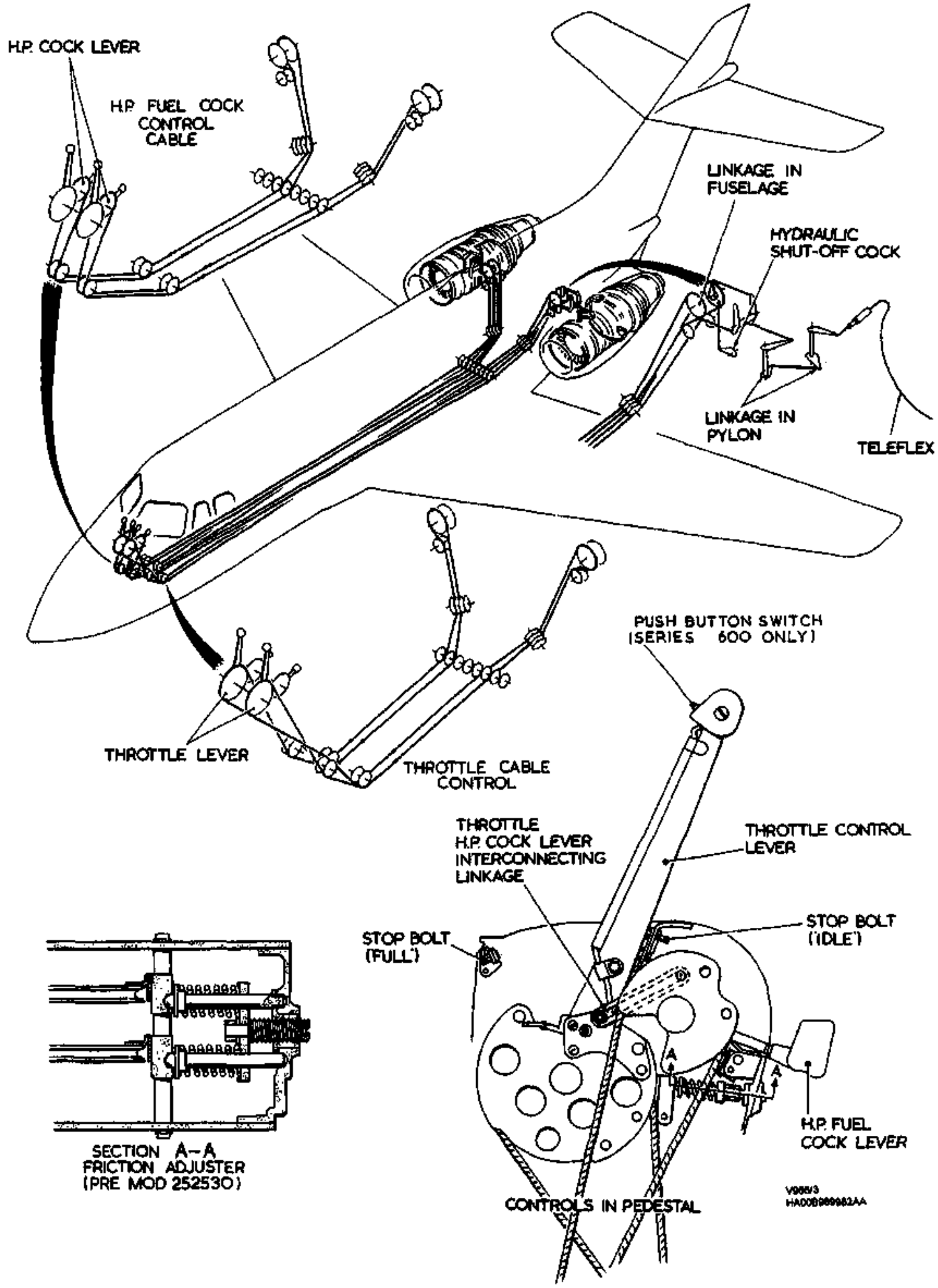
### A. Description

Each throttle control lever is attached to a cable drum in the control pedestal and its range of movement is controlled by an adjustable stop at the 'idle' and 'full' throttle positions.

The left throttle lever houses a landing gear/cabin pressure HORN ISOLATE push button switch (Chapter 21, AIR CONDITIONING - PRESSURIZATION).

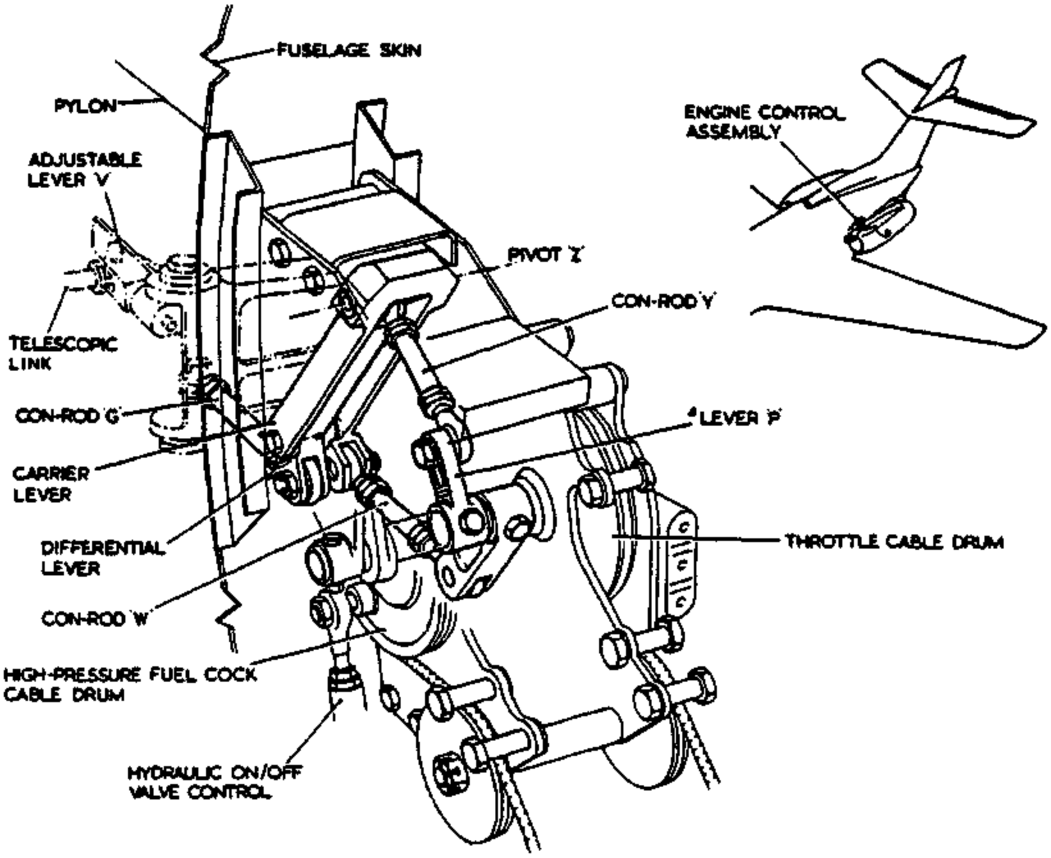
Within each engine control assembly are two microswitches operated by a cam on the throttle cable drum shaft. One switch controls electrical supplies to operate a warning horn if landing gear is not 'down' and 'locked' when engine power is reduced and the other operates the warning horn if the air brakes are 'out of position' when engine power is increased (Chapter 32, LANDING GEAR - ELECTRICAL INDICATING SYSTEM).

A throttle baulking device prevents both engines simultaneously exceeding 60% RPM when the elevator gust lock is engaged although each engine throttle lever can be individually advanced to 'full' power (Chapter 27, FLIGHT CONTROLS).

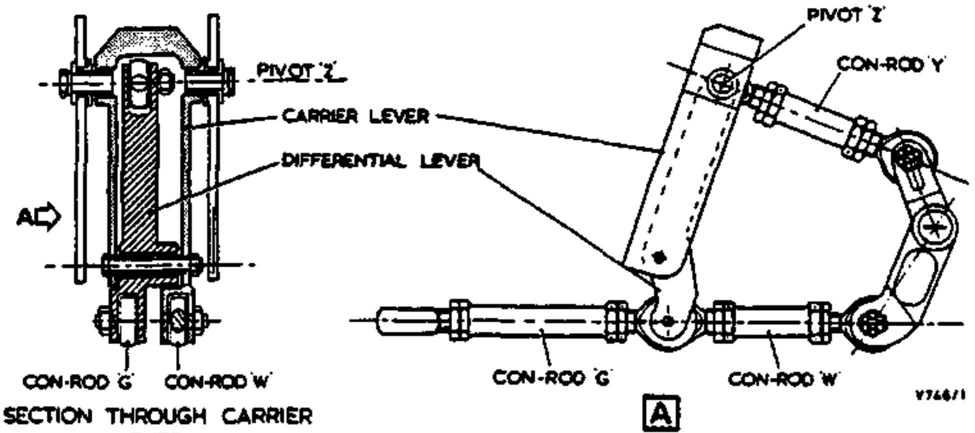


Power controls

*Figure 1*



ENGINE CONTROL ASSEMBLY



SECTION THROUGH CARRIER LEVER

Power control - left engine

*Figure 2*

### B. Operation *(Figure 2)*

Advancing a throttle lever from 'idling' to 'full' power rotates the cable drum in its engine control assembly which, through a lever and connecting rod moves the carrier lever, complete with pivoted differential lever, to operate the Teleflex control. This in turn rotates the power shaft in the fuel control unit across the throttle range without interference with the high pressure fuel cock control.

## 3. High pressure fuel cock control

### A. Description

Each high pressure fuel cock control lever is attached to a cable drum in the control pedestal and incorporates a spring-loaded 'on' plunger which engages with a recess at each end of its quadrant to lock the lever in either its OFF or ON position.

A detent cam and spring, installed adjacent to the cable drum in the engine control assembly, makes sure that a positive effort on the pedestal lever is required to 'break out' the spring from its cam when selecting the fuel cock 'ON'.

Each high pressure fuel cock control system is interconnected with an hydraulic ON-OFF valve such that hydraulic pump output is isolated whenever the high pressure fuel cock is closed (Chapter 29, HYDRAULIC - MAIN SYSTEM).

A microswitch operated by each high pressure fuel cock lever in the pedestal connects an electrical supply to the engine igniter unit when the cock lever is moved from OFF to ON (Chapter 80, ENGINE STARTING).

### B. Operation *(Figure 2)*

Moving the high pressure fuel cock lever in the control pedestal from OFF to ON rotates the cable drum in the engine control assembly which through a lever and connecting rod moves the differential lever, pivoted in the carrier lever, to operate the Teleflex control. This in turn rotates the power shaft in the fuel control unit through its initial range from shut (no fuel flow) to the throttle 'idle' setting. The differential lever reduces the high input movement imparted by operation of the fuel cock lever to a short travel on the Teleflex cable without applying throttle. Conversely it rotates the power shaft from 'idle' to shut when the cock lever is moved to OFF.

# POWER CONTROLS - ADJUSTMENT/TEST DUPLICATE INSPECTION

**CAUTION: WHENEVER ANY PART OF THIS SYSTEM IS DISMANTLED, ADJUSTED, REPAIRED OR RENEWED, DETAILED INVESTIGATION MUST BE MADE ON COMPLETION TO MAKE SURE THAT DISTORTION, TOOLS, RAG OR ANY OTHER LOOSE ARTICLES OR FOREIGN MATTER SUCH AS COULD IMPEDE THE FREE MOVEMENT AND SAFE OPERATION OF THE SYSTEM ARE NOT PRESENT AND THAT THE SYSTEM AND INSTALLATION IN THE WORK AREA ARE CLEAN.**

**CAUTION: WHENEVER ANY PART OF EITHER THE MAIN OR ANY ASSOCIATED SYSTEM IS DISMANTLED ADJUSTED, REPAIRED, OR RENEWED, THAT PART OF THE SYSTEM WHICH HAS BEEN DISTURBED SHALL BE SUBJECTED TO A DUPLICATE INSPECTION FOR SECURITY OF LOCKING DEVICES, FULL AND FREE MOVEMENT, DIRECTION AND TENSION CHECKS. THE COMPLETION OF THIS WORK SHALL BE CERTIFIED IN ACCORDANCE WITH THE AIRWORTHINESS AUTHORITY.**

## 1. Adjustment/Test

*NOTE: Use the procedures given in paragraph C and D if a full control system rigging check is required, i.e., after system breakdown for component or parts replacement. For these checks, the power plant and APU (if installed) must be removed, also air ducts and equipment sufficient to gain reasonable access to the throttle and HP cock cable drums in the engine control assembly is essential. For routine checks use the procedure given in paragraph E.*

*NOTE: To obtain access to the throttle or high pressure fuel cock cable turnbuckles, it is necessary to remove the MACH/ASI switch (refer to Chapter 34, MACH/AIRSPEED AUDIBLE WARNING SYSTEM), the pressure error corrector switch (refer to Chapter 34, SERVO ALTIMETER ALTITUDE ALERTING SYSTEM) and the switches mounting bracket as indicated in Figure 504.*

| Equipment/Material | Part/Item No. |
|---|---|
| Gauge, rigging Teleflex control | 25-7Y21A |
| Rigging pin set | 25-7Y15A |
| Tensiometer | – |
| Jointing compound | 309 (Chapter 20-95-301) |

### A. Rig throttle stops at center control pedestal *(Figure 501)*

(1) Screw back the 'idle' and 'full' throttle stop in the control pedestal.

(2) Move the throttle lever to the 'idle' position.

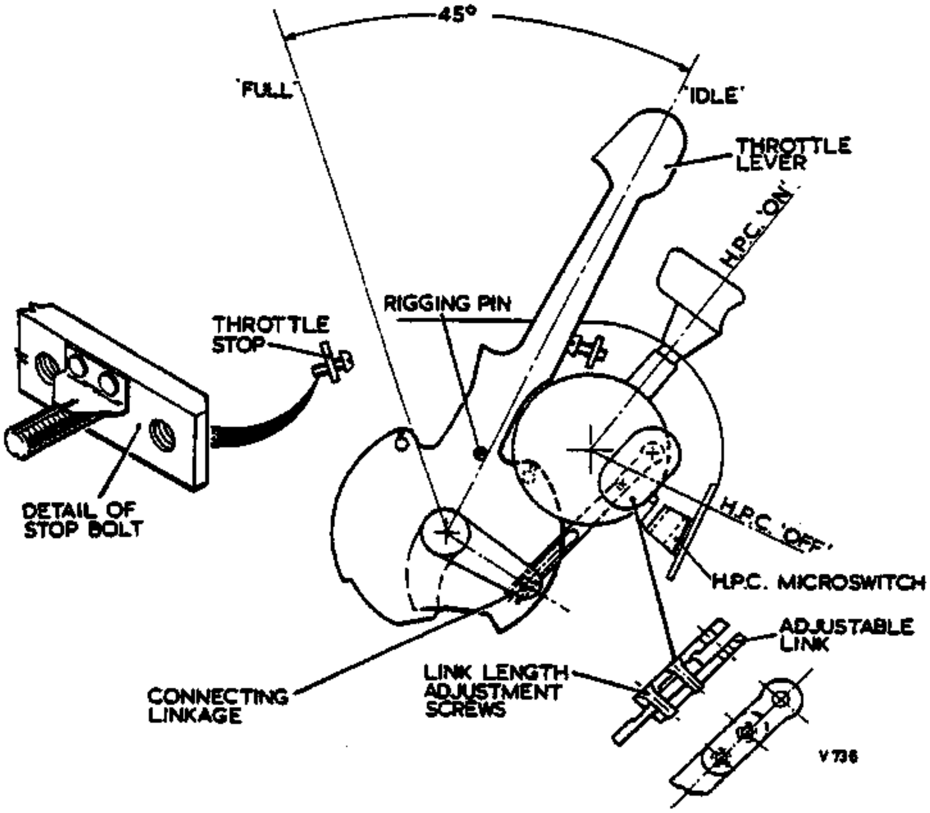
(3) Insert the rigging pin in the throttle lever.

(4) Adjust and lock the 'idle' stop in contact with the throttle lever.

(5) Remove the rigging pin.

(6) Set the throttle lever 45 degrees forward from the 'idle' position, i.e. 'full throttle' position.

(7) Adjust the 'full throttle' stop to contact the throttle lever. Secure and lock.



Throttle and high-pressure fuel cock levers rigging details
*Figure 501*

**B. Rig throttle/high pressure fuel cock levers interconnection** *(Figure 501)*

(1) Move the high pressure fuel cock lever to ON.

(2) Set the throttle lever up to the 'full' throttle stop.

(3) Move the high-pressure fuel cock lever from ON to OFF.

(4) Make sure that the interconnecting links move the throttle lever down to the throttle 'idle' stop.

*NOTE: If necessary, adjust the linkage:*

*(a) Loosen the screws in the adjustment link.*

*(b) Adjust the link to bring the throttle lever on to the 'idle' stop.*

*(c) Apply Loctite to the link and tighten up the link screws.*

(5) Make sure that the full throttle range is not restricted by the interconnecting linkage when the high-pressure fuel cock lever is moved to the on position.

### C. Rig the control cable systems *(Figure 502)*

(1) Disconnect one end of connecting rod 'G' *(Figure 502)* between the engine control assembly and pylon.

(2) Disconnect the hydraulic ON/OFF valve lever at the hydraulic cock (Chapter 29, HYDRAULIC - MAIN SYSTEM, ON/OFF VALVE).

(3) Insert a rigging pin in the throttle lever at the 'idle' position *(Figure 501)*.

(4) Set the high-pressure fuel cock lever to ON.

(5) Insert a rigging pin in the rear cable drums of both the throttle and high pressure fuel cock control systems in the engine control assembly.

(6) Tension the throttle and the high-pressure fuel cock control system cables to 25 to 30 lb.

(7) Make sure cable turnbuckles are in safety and wire-locked.

(8) Remove the rigging pins and operate the throttle and high-pressure fuel cock cable systems several times. Make sure there is freedom of movement.

(9) Examine the rigging pin hole alignment in the throttle lever and high-pressure fuel cock rear cable drums in the engine control assembly.

(10) If the rigging pin holes are out of alignment, repeat paragraphs (1) to (9).

(11) Connect up the hydraulic ON/OFF valve lever and lock.

(12) Connect and lock connecting rod G.

### D. Rig Teleflex control in pylon *(Figure 502 and Figure 503)*

**CAUTION: DO NOT ADJUST CONNECTING ROD 'X' AND 'W', IDENTIFIED ON *FIGURE 502*.**

*NOTE: For FCU power lever shaft protractor angles, refer to Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, Page block 401.*

(1) Remove power plant (Chapter 71, POWER PLANT - GENERAL, page block B401) but disconnect Teleflex at quick-disconnect coupling in pylon.

(2) Make sure that the high-pressure fuel cock lever is in the ON position.

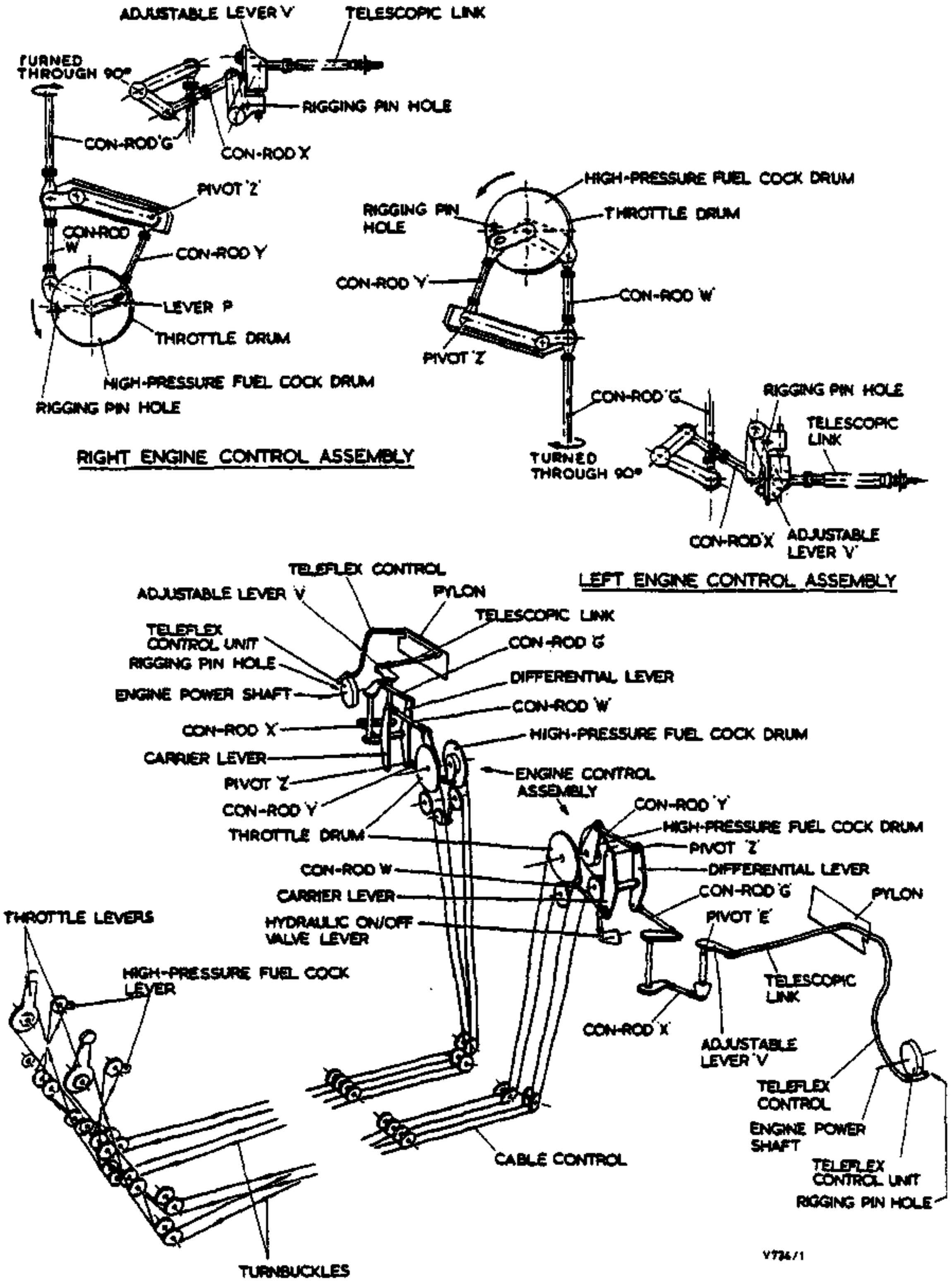
(3) Install rigging pin at the engine control assembly adjustable lever 'V'.

(4) Make sure that pivot 'Z' of the lever carrier and the center of the eye-end of rod 'Y' are in co-axial alignment.

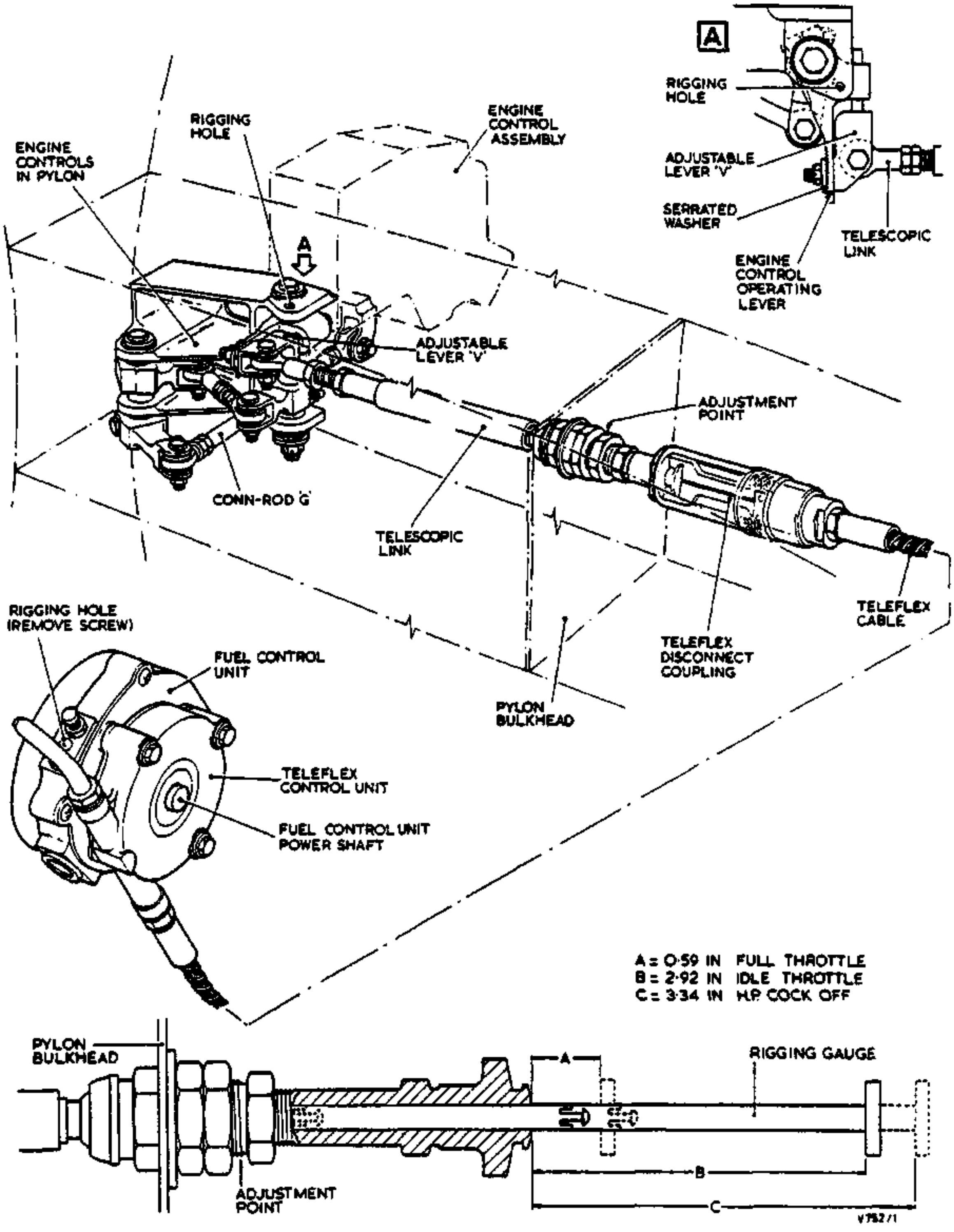
*NOTE: If necessary, adjust the length of connecting rod 'G' to obtain co-axial alignment. Tighten locknuts and wire-lock connecting rod 'G' after any adjustment.*

(5) Set lever 'V' to mid-adjustment on its serrated face.

(6) Adjust the Teleflex control telescopic connecting unit length to pick up with lever 'V'. Attach unit to lever, secure and wire-lock.

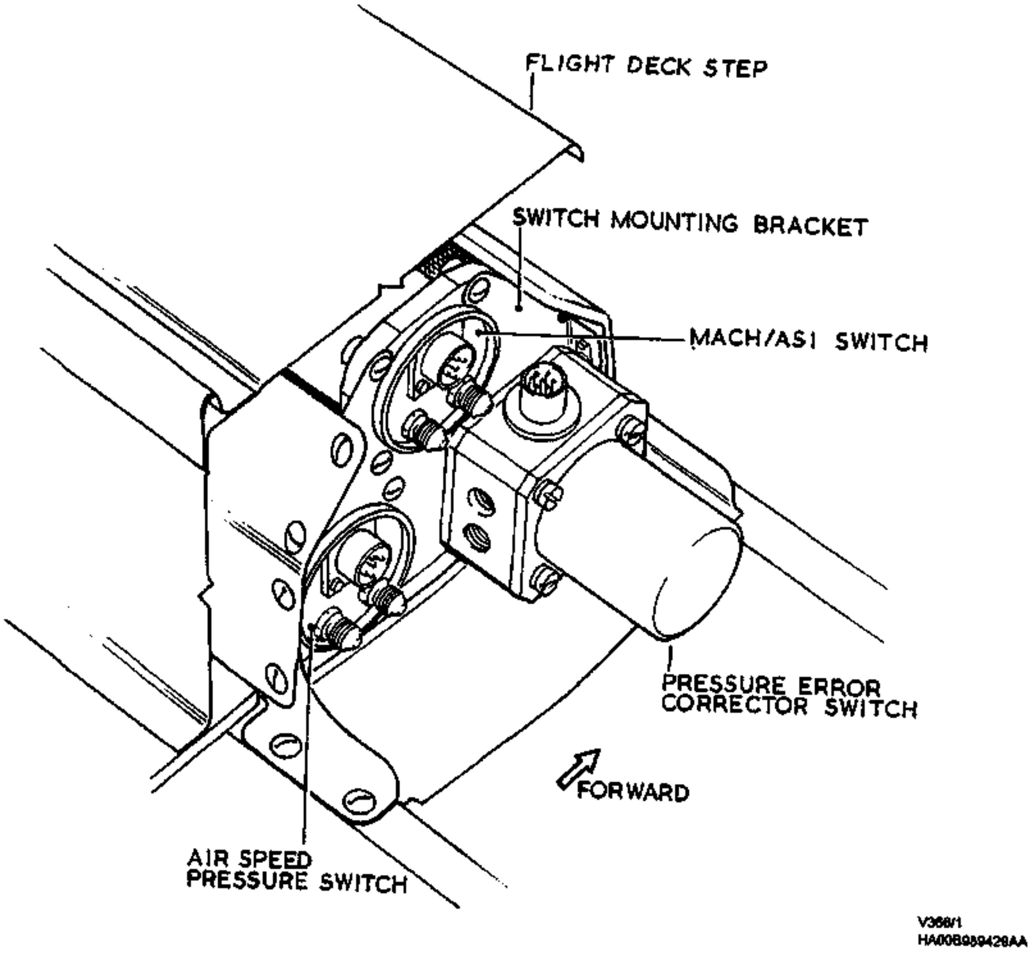


Power control system rigging details
*Figure 502*



Teleflex control rigging details

*Figure 503*



Mach/ASI and pressure error corrector switch locations
*Figure 504*

(7) Attach rigging gauge to Teleflex quick-disconnect terminal and adjust Teleflex rod end to give rigging gauge dimension 'B'.

(8) Remove rigging pin from lever 'V' and move throttle lever to its 'full power' stop.

(9) Adjust radius of lever 'V' to produce rigging gauge dimension 'A' as follows:

  (a) Increase lever 'V' radius to give less throttle travel.

  (b) Decrease lever 'V' radius to give more throttle travel.

(10) Return throttle lever to its IDLE rev/min stop and check dimension 'B' at the rigging gauge is 2.92 in. ± 0.01 in.

(11) Leaving the throttle lever at IDLE rev/min setting, move the HP fuel cock lever to OFF.

(12) Adjust radius of serrated lever at point 'P' to produce rigging gauge dimension 'C' as follows:

(a) Increase lever 'P' radius to give more engine power lever movement, i.e., more h.p. fuel cock movement, at engine power shaft indicator.

(b) Decrease lever 'P' radius to lessen the h.p. cock movement at engine power shaft indicator.

(13) If the radius of lever 'P' is altered, adjust the length of connecting rod 'Y' to the differential lever to satisfy the requirements of paragraph D paragraphs (1) to (4).

(14) Check, and adjust throttle microswitches as necessary (Chapter 32, LANDING GEAR - ELECTRICAL INDICATING SYSTEM).

(15) Remove rigging gauge and lock all places where adjustments have been made.

(16) Take the opportunity to lubricate engine control system within the pylon.

(17) Reconnect teleflex control quick-disconnect coupling in pylon.

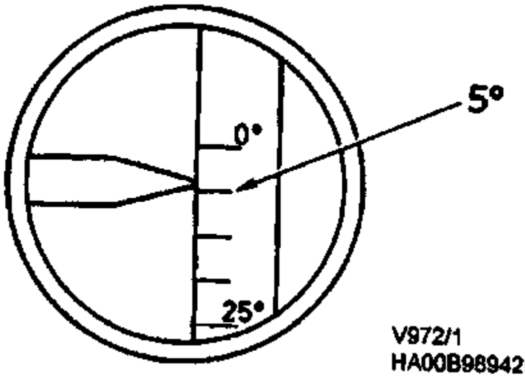
(18) Install power plant (Chapter 71, POWER PLANT - GENERAL).

**E. Function test engine power scheduling indicator response**

(1) Set the throttle lever at its 'full' stop.

(2) Move the high pressure fuel cock lever from OFF to ON.

(3) Move the fuel cock lever from ON to OFF and check that the pointer on the engine power scheduling indicator is within 5 degrees of the 0 (zero degree) mark (Figure 505).



V972/1
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Engine power scheduling indicator
*Figure 505*

F. **Periodic check/adjust control system**

(1) Using a tensiometer, check throttle and HP fuel cock cable circuits tension is 25 to 30 lbs.

(2) If cable tensiometer reading is at variance with tension band given in paragraph (1):

(a) Remove sealing screw to expose rig pinhole in the fuel control unit *(Figure 504).*

(b) Set throttle(s) to IDLE rev/min and insert rig pin.

(c) Set HP fuel cock lever to ON.

(d) Tension the appropriate cable circuit to 25-30 lb making sure that a rigging pin can be inserted in the fuel control unit.

*NOTE: A 0.125 in. +0 / -0.002 in. diameter rod may be used as a rigging pin.*

*NOTE: If difficulty is experienced with rigging pin insertion, it may be necessary to slightly shorten one cable and similarly lengthen the other cable using both cable adjusters to maintain the correct tension.*

(e) Remove rigging from the throttle lever and return high pressure fuel cock lever to OFF.

(f) Re-install rigging pin hole closing screw to fuel control unit.

(g) Make sure all cable adjusters are in safety, locked and wire-locked.

G. **Functional checks**

(1) Throttle control friction-circuit complete and rigged:

(a) Set high pressure fuel cock lever to ON.

(b) Using a 0-10 lb spring balance attached to the center of the throttle lever knob, pull the throttle lever from its 'idle rev/min' stop to its 'full power' stop and make sure the spring balance reading is not in excess of 6 lb while moving.

(c) Repeat (b) pulling the throttle lever from full power to its idle rev/min stop.

(d) Return high pressure fuel cock lever to OFF.

(2) Throttle/HP fuel cock lever interconnection:

(a) Set the high pressure fuel cock lever to ON.

(b) Move the throttle lever to its full power stop.

(c) Move high pressure fuel cock lever from ON to OFF and check-throttle lever is returned to its idle rev/min stop.

(d) Start up the engine (Chapter 71, POWER PLANT - GENERAL).

(e) Advance the throttle lever one inch from its idle rev/min stop.

(f) Move high pressure fuel cock lever from ON to OFF and make sure engine positively shuts down.

(g) Complete engine shut down checks.

**H. Check/adjust throttle levers alignment**

(1) Disconnect and remove lower access door from each engine.

(2) Start left or right engine (refer to Chapter 71, POWER PLANT - GENERAL).

(3) Advance throttle lever to 75% r.p.m.

*NOTE: Observe 75% r.p.m. on associated N1 indicator.*

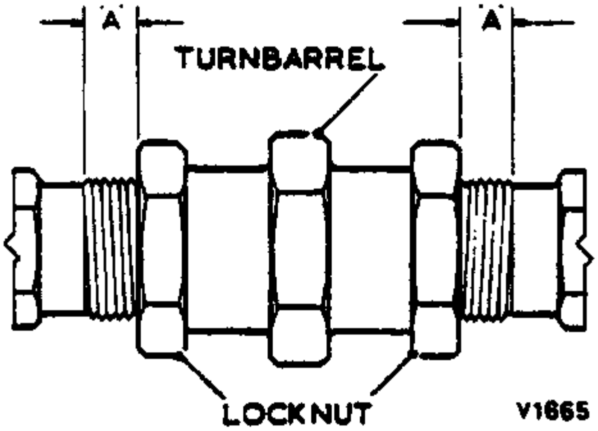
(4) Apply scotch tape on throttle box adjacent to lever of live engine and mark angular disposition of lever.

(5) Stop engine (refer to Chapter 71, POWER PLANT - GENERAL).

(6) Start opposite engine and advance throttle to 75%.

(7) Check alignment of throttle lever with mark on scotch tape. There must be no visible stagger.

*NOTE: If throttle lever stagger is evident, stop the engine and proceed as on Figure 506 for the engine just stopped.*



Teleflex control micro-adjustment
*Figure 506*

**I. Adjust micro-adjuster on Teleflex control** *( Figure 506)*

(1) Remove locking wire.

(2) Release locknuts.

(3) Rotate turnbarrel clockwise or counter-clockwise to adjust throttle lever until it aligns with the mark on the tape.

(4) With the locknuts abutting the turnbarrel, check not more than six threads protrude at 'A'.

(5) Tighten locknuts and wire-lock.

*NOTE: If 'A' exceeds six threads protrusion, revert adjuster to mid position and adjust micro-adjuster on other engine.*

# ENGINE CONTROLS SUB-ASSEMBLIES AND COMPONENTS REMOVAL/INSTALLATION

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF, AN ENGINE. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER SUCH COMPONENT IS REMOVED, IMMEDIATELY INSTALL A CAP TO THE APERTURE.**

*NOTE: Reference is made to the pertinent Removal/Installation procedure as detailed in Allied Signal, Light Maintenance Manual, Report No. 72-02-15.*

## 1. Procedure

### A. Sub-assemblies and components *(Refer to Allied Signal, Light Maintenance Manual)*

(1) Solenoid controller valve, surge bleed and anti-ice compressor. Chapter 76-10-01.

### B. Access procedure

(1) Remove lower access door.

(a) At the inboard latches on the door insert a short screwdriver (approximately three inches long) into each facia slot and turn lever outboard to release. Open the access door.

(b) With the door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into each facia hole. Lever outboard to release. Remove access door.

(2) Isolate pertinent electrical supplies by removing fuses and/or opening circuit breakers (refer to Table 401).

### C. Close up

(1) Install lower access door.

(a) Position the door up to the hinge bars on the upper panel. Close the hinge latches and make sure they seat flush.

(b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal, (refer to page block 301 of Chapter 71-10-00).*

(2) Restore electrical supplies by installing fuses and/or closing circuit breakers (refer to Table 401).

### D. Adjustment/test

(1) Ground test the engine - refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

Table 401 (Series F400)
ENGINES - POWER SUPPLIES

| Circuit | | Sub-panel D - circuit breaker | Sub-panel E - circuit breaker | Panel ZK - fuse | Panel ZL - fuse |
|---|---|---|---|---|---|
| Fuel filter | Left<br>Right | -<br>- | -<br>- | -<br>- | F16<br>F17 |
| Fuel temperature | Left<br>Right | -<br>- | -<br>- | -<br>- | F18<br>F19 |
| Oil low pressure | Left<br>Right | -<br>- | -<br>- | -<br>- | F21<br>F22 |
| Oil temperature | Left<br>Right | -<br>- | B21<br>B22 | -<br>- | -<br>- |
| Oil pressure | Left<br>Right | B15<br>B16 | -<br>- | -<br>- | -<br>- |
| Fuel flowmeter | Left<br>Right | -<br>- | -<br>- | F38, F39<br>F38, F48 | -<br>- |
| Fire detection | Left<br>Right | -<br>B22 | -<br>- | -<br>- | F12<br>F11 |
| Engine/intake de-ice | Left<br>Right | B50<br>B51 | -<br>- | F24<br>F25 | -<br>- |
| Engine r.p.m. | Left<br>Right | -<br>- | -<br>- | F34, F35, F44, F45<br>F29, F30, F54, F55, | -<br>- |
| I.T.T. | Left<br>Right | -<br>- | -<br>- | F28<br>F28 | -<br>- |
| Ignition | Left<br>Right | -<br>- | -<br>- | -<br>- | F5<br>F6 |
| No.1 fuel computer | | - | - | F10, F31 | - |
| No.2 fuel computer | | - | - | F11, F20, F32 | - |

# THROTTLE CONTROLS TELEFLEX CABLE LUBRICATION

## 1. General

The following procedure is to be done only when the engine is to be changed or at the engine Major Period Inspection.

## 2. Procedure

| Equipment/Material | Part/Item No. |
|---|---|
| Silicone grease | Item 046 (Chapter 20-95-11) |

### A. Remove the cable

(1) Make sure the throttle is set to IDLE RPM and the HP cock is set to OFF.

(2) Release the throttle control Teleflex cable at the disconnect coupling at the pylon bulkhead.

(3) Remove the spare-travel tube from the Teleflex control unit.

(4) Measure and record the length of the Teleflex cable which comes out of the Teleflex control unit.

(5) Hold the disconnect coupling and unwind the Teleflex cable until it is free from the gear wheel in the Teleflex control unit.

(6) Pull the Teleflex cable out of the conduit.

(7) Make sure the cable has no visible damage and no kinks.

### B. Lubrication

**CAUTION: DO NOT CLEAN THE CABLE WITH SOLVENTS.**

(1) Remove the used grease from the cable with a lint-free cloth.

**CAUTION: THE SPACE BETWEEN THE CABLE AND THE CONDUIT MUST NOT BE PACKED WITH GREASE.**

(2) Put a thin layer of silicone grease (Item No. 046) on the cable. Do not put any grease on the 6 inches of cable which will engage with the gear wheel when the cable is installed.

### C. Installation

(1) Slide the cable into its conduit until it reaches the Teleflex control unit.

(2) Support the cable, hold the disconnect coupling and carefully wind the cable into the Teleflex control unit until you have the dimension recorded at paragraph 2.A.(4).

(3) Install the spare-travel tube to the Teleflex control unit.

(4) Connect the disconnect coupling at the pylon bulkhead.

(5) Lock all connections.

**D. Checks/tests**

(1) Do a friction test (Chapter 76-10-00).

(2) All other checks and tests to be done on completion of the engine installation (Chapter 76-10-00).

# CHAPTER

# 77

# ENGINE INDICATING

# CHAPTER 77

# ENGINE INDICATING

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# ENGINE INDICATING
# DESCRIPTION

## 1. General *(Figure 1)*

The engine indicators are on the pilots' center instrument panel and consists of the following:

Interstage turbine temperature (ITT) indicator
Low pressure (N1) rotor r.p.m. indicator
High pressure (N2) rotor r.p.m. indicator.

## 2. Interstage turbine temperature (I.T.T.) indication (Pre-Mod.252835)

The turbine temperature is measured by ten Chromel-Alumel thermocouples positioned in the efflux path between the low and high pressure turbine sections. Two thermocouple harnesses, of five probes each, are connected in parallel to provide an averaging circuit. Each thermocouple harness terminates at a connector for the associated electronic computer and a pair of flying leads for the indicator.

ITT indication is given by an instrument having a pointer moving over a dial marked 0 to 12 in °C x 100 in increments of 50° C and by a four digit counter display. A power OFF flag is inset in the dial face.

The dial periphery is color banded.

230 to 885° C - Green
885 to 907° C - Amber
907 to 920° C - Red.

Power supplies for the indicators are taken from XS2 a.c. busbar by way of a normally energized relay. In the event of a failure of this power source, the relay becomes de-energized to connect an alternative supply from a static inverter operated by a supply from the essential busbar.

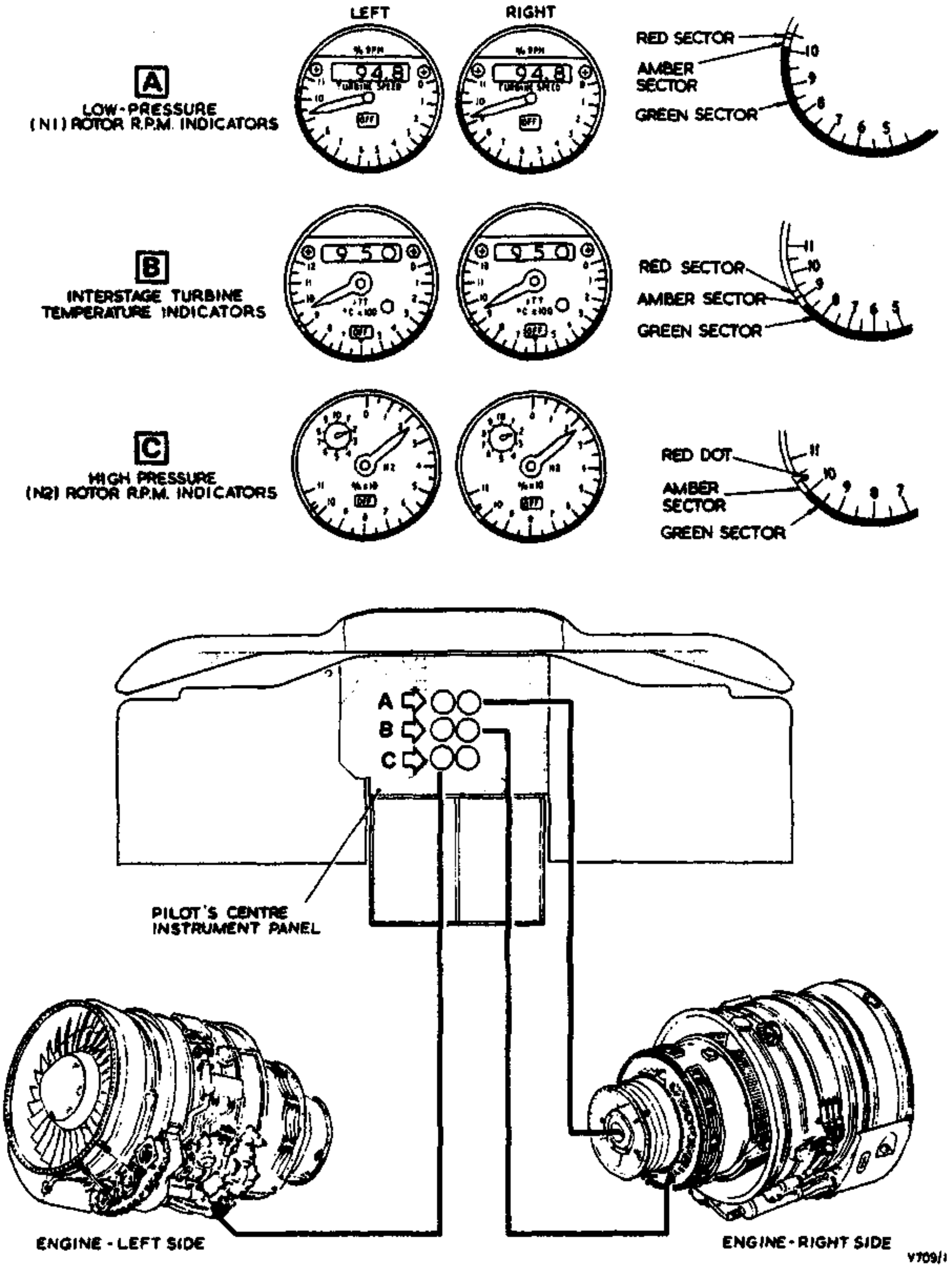
Integral lighting for each indicator is by a supply taken from the flight compartment lighting supply system.

## 3. Interstage turbine temperature (I.T.T.) indication (Mod.252835)

The turbine temperature is measured and transmitted to a connector for the associated fuel computer and I.T.T. indicator flying leads as for Pre-Mod.252835 indicators (paragraph 2).

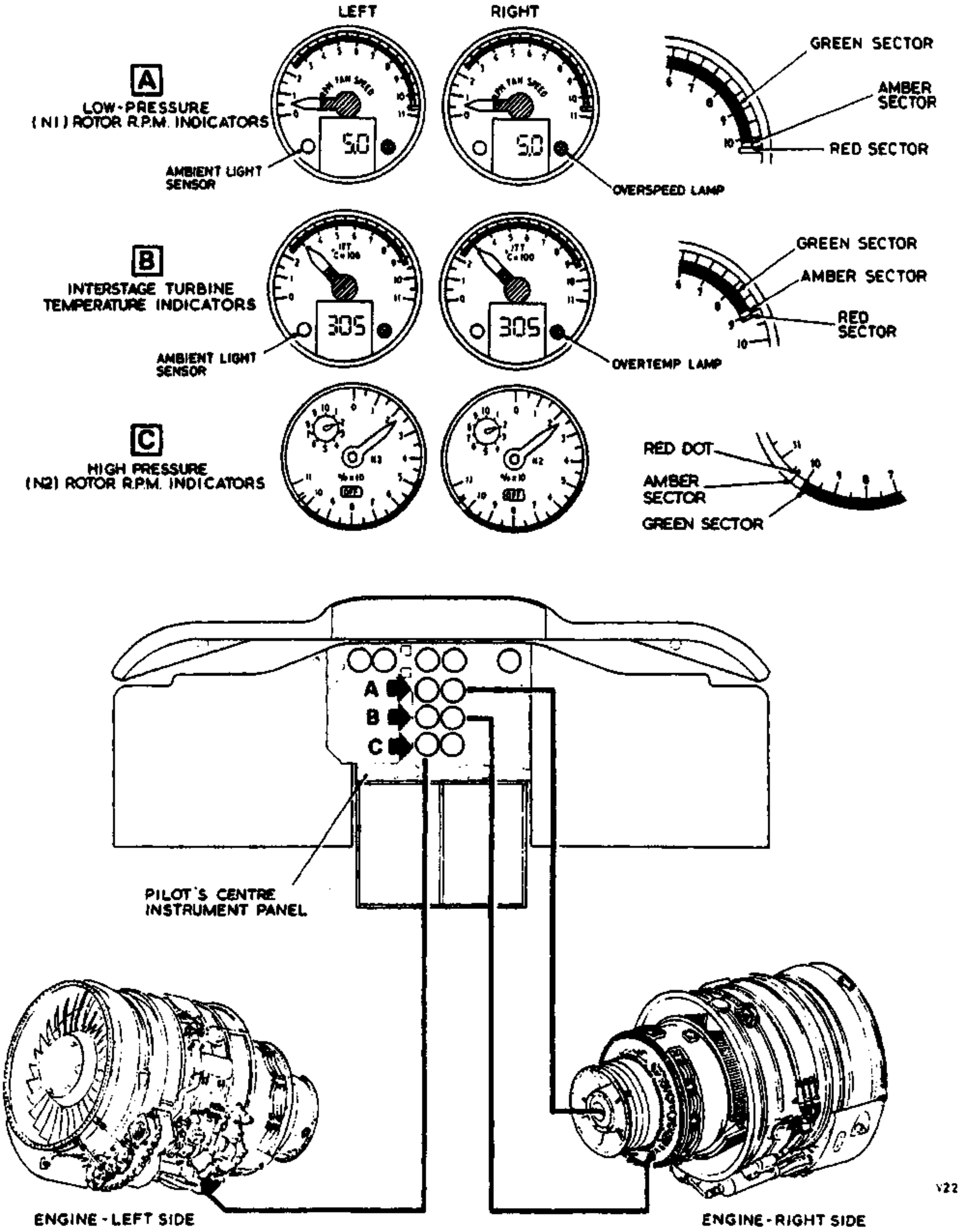
I.T.T. indication is given by a d.c. operated instrument with a pointer moving over a dial marked 0 to 11 in 0° C x 100 in increments of 50° C. More precise indication (1° C resolution) is shown by a digital incandescent fibre-optic display with automatically variable brightness controlled by a photocell. 'Power off' is indicated by a blank digital display.

Included on the dial of the instrument is a red overtemperature lamp which comes on at 917 ± 1° C. The dial periphery is color banded similar to Pre-Mod. instruments (paragraph 2).



Engine indicating (Pre-Mod.252835)

*Figure 1*



Engine indicating (Mod.252835)

*Figure 2*

Indicator accuracy:

(a) Digital: ± 2° C from 20 to 30° C ambient temperature
± 5° C from - 40 to + 71° C ambient temperature.

(b) Pointer: ± 2% of full scale for - 40 to + 71° C ambient temperature integral lighting is supplied from the flight compartment lighting supply. Power supplies for the indicators are taken from PS1 busbar left engine and PS2 busbar right engine, with automatic switching to PE2 busbar should PS1 or PS2 busbars fail.

## 4. Low pressure (N1) rotor r.p.m. indication (Pre-Mod.252835)

N1 speed is measured by a monopole transducer on each engine. A magnetic speed pick-up, located at the rear end of the low pressure turbine shaft, produces two output signals which represent turbine speed. One signal is fed to the associated electronic computer and the other is connected to the indicator by way of an amplifier.

Indication of N1 rotor speed is presented in % RPM by a pointer moving over a dial marked 0-11 and by a four digit counter displaying increments of 0.1%. A power OFF flag is inset in the dial face.

The dial periphery is color banded:

24% to 101.5% - Green
101.5% to 103% - Amber
103% to 105% - Red.

Power supplies for the N1 indicators are taken from normal d.c. busbars by way of normally energized relays. In the event of a power failure from this source, the relays become de-energized to connect an alternative supply from the essential busbar.

Integral lighting for each indicator is by a supply taken from the flight compartment lighting supply system.

## 5. Low pressure (N1) rotor r.p.m. indication (Mod.252835)

N1 speed is measured and transmitted to the associated fuel computer and N1 indicator similar to Pre-Mod. system (paragraph 4) except that an amplifier is not utilized.

Indication of N1 rotor speed is given by a d.c. operated instrument with a pointer moving over the dial marked 0 to 11 in % R.P.M. x 10, in increments of 5%. More precise indication (0.1% resolution) is shown by a digital incandescent fibre-optic display with automatically variable brightness controlled by a photocell. 'Power-off' is indicated by a blank digital display. Included on the dial of the instrument is a red overspeed lamp which comes on at 104.0 ± 0.1%. The dial periphery is colour banded similar to Pre-Mod. instruments (paragraph 4).

Indicator accuracy:

(a) Digital: ± 0.1% of full scale from 20 to 30° C ambient temperature with readings from 10.0 to 120.0%
± 0.25% of full scale from - 40 to + 71° C ambient temperature with readings from 10.0 to 120.0%.

(b) Pointer: ± 2% of full scale from - 40 to + 71° C ambient temperature.

Integral lighting is supplied from the flight compartment lighting supply. Power supplies for the indicators are taken from PS1 busbar left engine and PS2 busbar right engine, with automatic switching to PE2 busbar, should PS1 or PS2 busbars fail.

## 6. High pressure (N2) rotor r.p.m. indication

The N2 indicator is connected to a magnetic speed pick-up mounted in the rear of the engine transfer gearbox. There are two output signals from the pick-up, one to the associated electronic computer and the other connects with the indicator.

Indication of N2 rotor speed is presented by a pointer moving over a dial marked 0 to 11 in % x 10 r.p.m. A secondary pointer makes one revolution of its scale for each 10% movement of the main pointer. A power OFF flag is inset in the main dial face.

The dial periphery is color banded:

48% to 100% - Green
100% to 103% - Amber
At 103% there is a Red dot.

Power supplies for N2 indicators are the same as that given for the N1 indicators.

# ENGINE INDICATING
# SUB-ASSEMBLIES AND COMPONENTS
# REMOVAL/INSTALLATION

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF, AN ENGINE. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER SUCH COMPONENT IS REMOVED, IMMEDIATELY INSTALL A CAP TO THE APERTURE.**

*NOTE: The procedures required to gain access to Allied Signal engine sub-assemblies and components, to permit their removal from an installed power plant, are grouped into "common access procedural" groups. Reference is also made to the pertinent Removal/Installation procedure as detailed in the Allied Signal, Light Maintenance Manual, Report No. 72-02-15.*

## 1. Group 1 - Procedures

### A. Group 1 - sub-assemblies and components *(Refer to Allied Signal, Light Maintenance Manual)*

| | |
|---|---|
| (1) Cover plate - transducer access | Chapter 77-10-01. |
| (2) Transducer N1 | Chapter 77-10-02. |

### B. Group 1 - access procedure

*NOTE: Due to the complexity of the bolt-up arrangement at the engine rear mount fairing and the necessity for correct identification of bolts, nuts and washers during disassembly and assembly it is recommended that an aide-memoire panel for storage of bolts etc. be locally manufactured. The panel can be made from thin metal sheet or plywood using the layout given in Figure 404 Sheet 1 suitably enlarged. Drill the holes using a 4.9 mm diameter drill and stencil LH on the obverse face and RH on the reverse face.*

(1) Remove lower access door.

(a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot and lever outboard to release. Open the access door.

(b) With the door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into each facia hole and lever outboard to release. Remove the access door.

(2) Remove upper panel.

(a) At the aft edge of the panel, insert a suitable 0.25 in.diameter rod into the facia hole of each shear pin latch and lever outboard to release.

(b) At the forward edge of the upper panel, remove three countersunk bolts securing the panel to the inlet cowl. Carefully remove upper panel making sure that its hinge bars (3) do not damage local electrical cables or looms.

(3) Isolate pertinent electrical power supplies by removing fuses and/or opening circuit breakers (refer to Table 401).

(4) Remove engine rear mount access panels from pylon top and bottom surfaces.

(5) Remove aft cowl assembly *(Figure 401).*

(a) Remove aft cowl assembly top and bottom outer closing panels.

(b) Remove bolts etc. from the longitudinal edges of the upper panel and lower panel assembly and aft cowl inner skin. Stow the attachments in the aide-memoire panel.

(c) Remove bolts etc. connecting the rear angle to the aft cowl inner skin. Stow bolts etc. in the aide-memoire panel.

*NOTE: The upper panel and lower panel assembly are left connected to the attachment flange on the engine.*

(d) Disconnect electrical leads and pipes from their P-clips on the aft cowl forward diaphragm.

(e) Support aft cowl assembly then remove nuts, washers and bolts from the aft cowl/engine fan duct flange (except at attachment locations 10-19 (left engine) or 37-46 (right engine)).

(f) Remove aft cowl assembly rearwards.

(6) Remove fan exhaust duct inner top and bottom skin panels *(Figure 402).*

(a) Remove screws and washers securing high pressure air bleed pipe fairing to top panel and remove the fairing.

(b) Remove screws and washers from top panel forward periphery and longitudinal lap joints and remove top panel.

(c) Support bottom panel, remove screws and washers at forward periphery and remove bottom panel.

(7) Remove exhaust tube assembly.

(a) Support exhaust tube assembly.

(b) Unscrew exhaust tube clamp T-bolt self-locking high temperature nuts. Remove clamp and withdraw exhaust tube assembly rearwards.

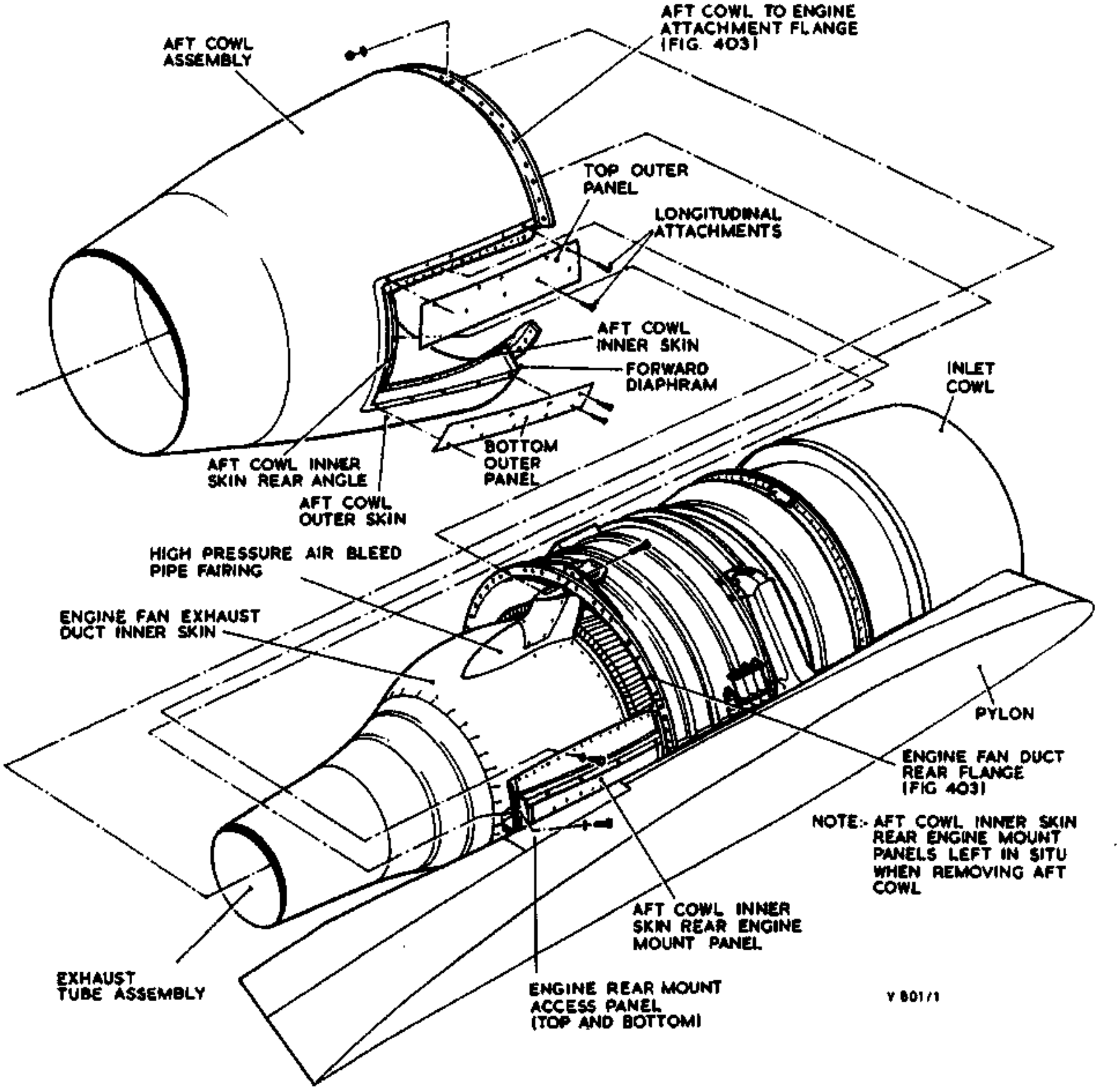
(8) Dismantle engine rear mount fairing *(Figure 403 and Figure 404).*

(a) Remove bolts and washers (6 off) securing the upper fairing to the lower fairing.

(b) Remove bolts etc. securing upper fairing to lower panel and remove upper fairing. Stow bolts etc. in the aide-memoire panel.

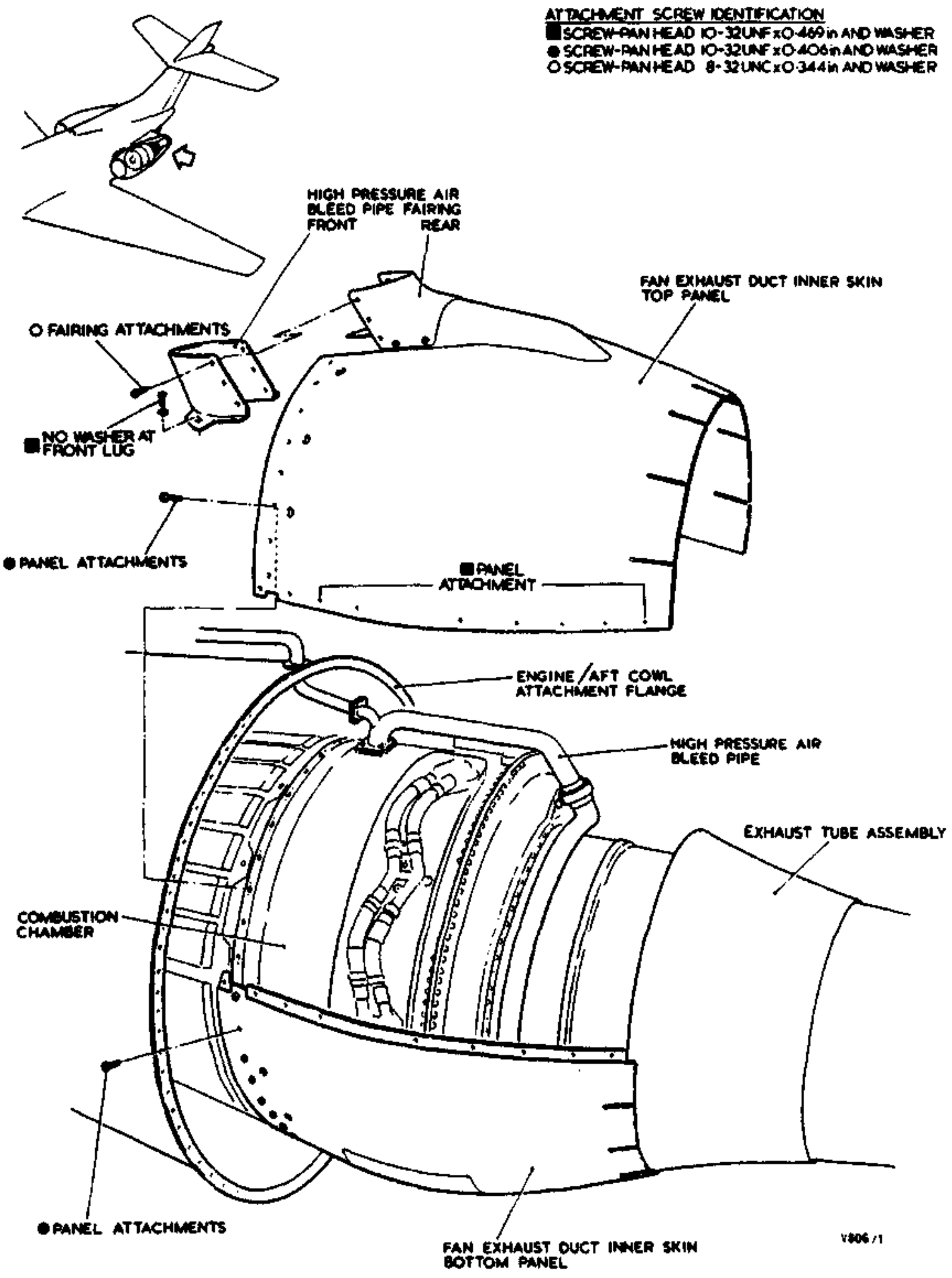
(c) Remove remaining bolts securing upper panel to lower panel assembly and remove upper panel. Stow bolts in the aide-memoire panel.

(d) Remove bolts etc. from matching half-shields and seals. Stow bolts etc. in the aide-memoire panel. Remove matching half-shields and seals.

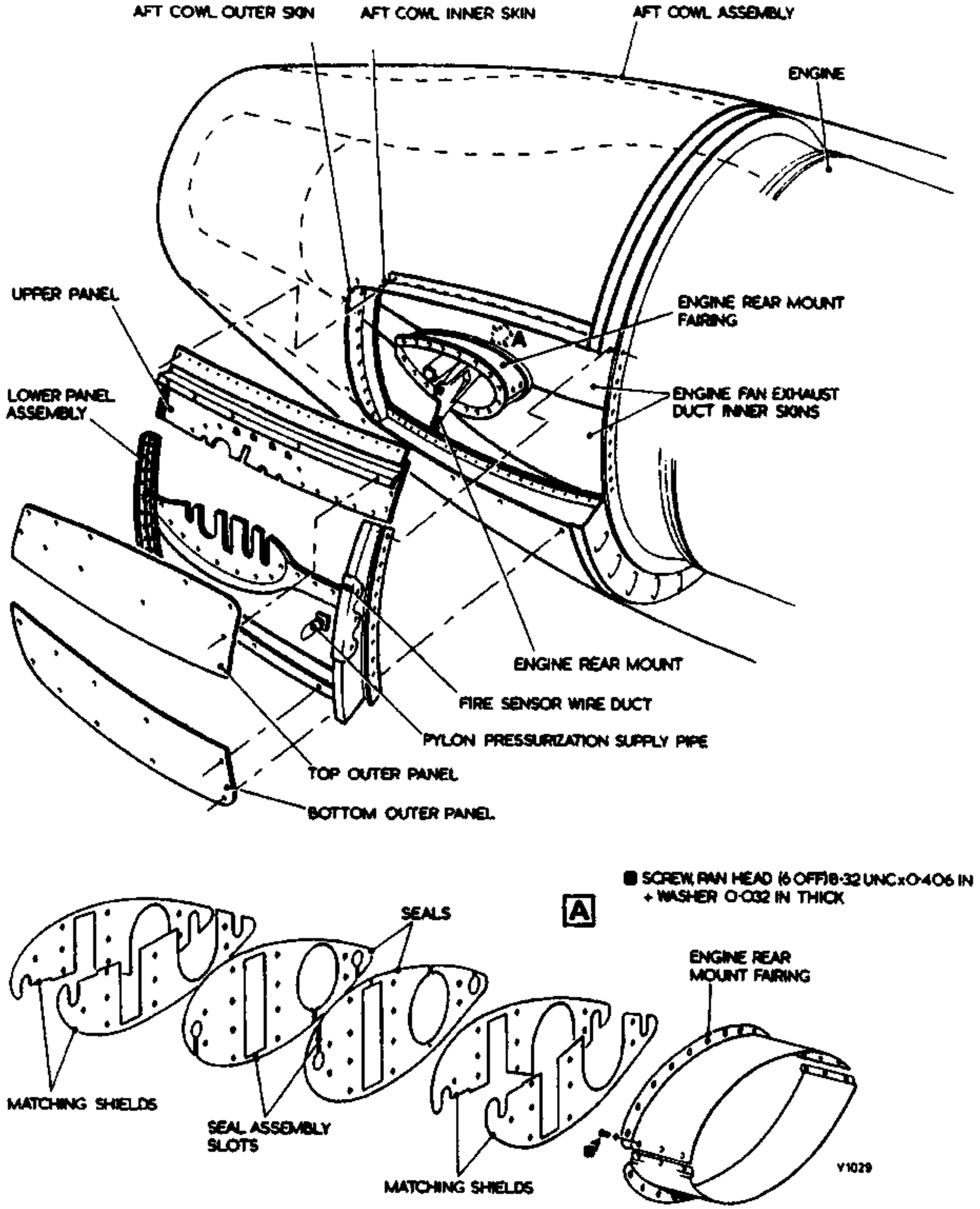

AFT COWL ASSEMBLY
AFT COWL TO ENGINE ATTACHMENT FLANGE (FIG. 403)
TOP OUTER PANEL
LONGITUDINAL ATTACHMENTS
AFT COWL INNER SKIN
FORWARD DIAPHRAM
INLET COWL
BOTTOM OUTER PANEL
AFT COWL INNER SKIN REAR ANGLE
AFT COWL OUTER SKIN
HIGH PRESSURE AIR BLEED PIPE FAIRING
ENGINE FAN EXHAUST DUCT INNER SKIN
PYLON
ENGINE FAN DUCT REAR FLANGE (FIG 403)
NOTE:- AFT COWL INNER SKIN REAR ENGINE MOUNT PANELS LEFT IN SITU WHEN REMOVING AFT COWL
AFT COWL INNER SKIN REAR ENGINE MOUNT PANEL
EXHAUST TUBE ASSEMBLY
ENGINE REAR MOUNT ACCESS PANEL (TOP AND BOTTOM)
Y 801/1

Aft cowl removal

*Figure 401*

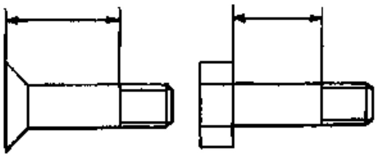

ATTACHMENT SCREW IDENTIFICATION
■ SCREW-PAN HEAD 10-32UNF x 0·469 in AND WASHER
● SCREW-PAN HEAD 10-32UNF x 0·406 in AND WASHER
○ SCREW-PAN HEAD 8-32UNC x 0·344 in AND WASHER
HIGH PRESSURE AIR BLEED PIPE FAIRING
FRONT
REAR
FAN EXHAUST DUCT INNER SKIN TOP PANEL
○ FAIRING ATTACHMENTS
■ NO WASHER AT FRONT LUG
● PANEL ATTACHMENTS
■ PANEL ATTACHMENT
ENGINE/AFT COWL ATTACHMENT FLANGE
HIGH PRESSURE AIR BLEED PIPE
EXHAUST TUBE ASSEMBLY
COMBUSTION CHAMBER
● PANEL ATTACHMENTS
FAN EXHAUST DUCT INNER SKIN BOTTOM PANEL
V806/1

Fan exhaust duct inner top and
bottom skin panels removal
*Figure 402*

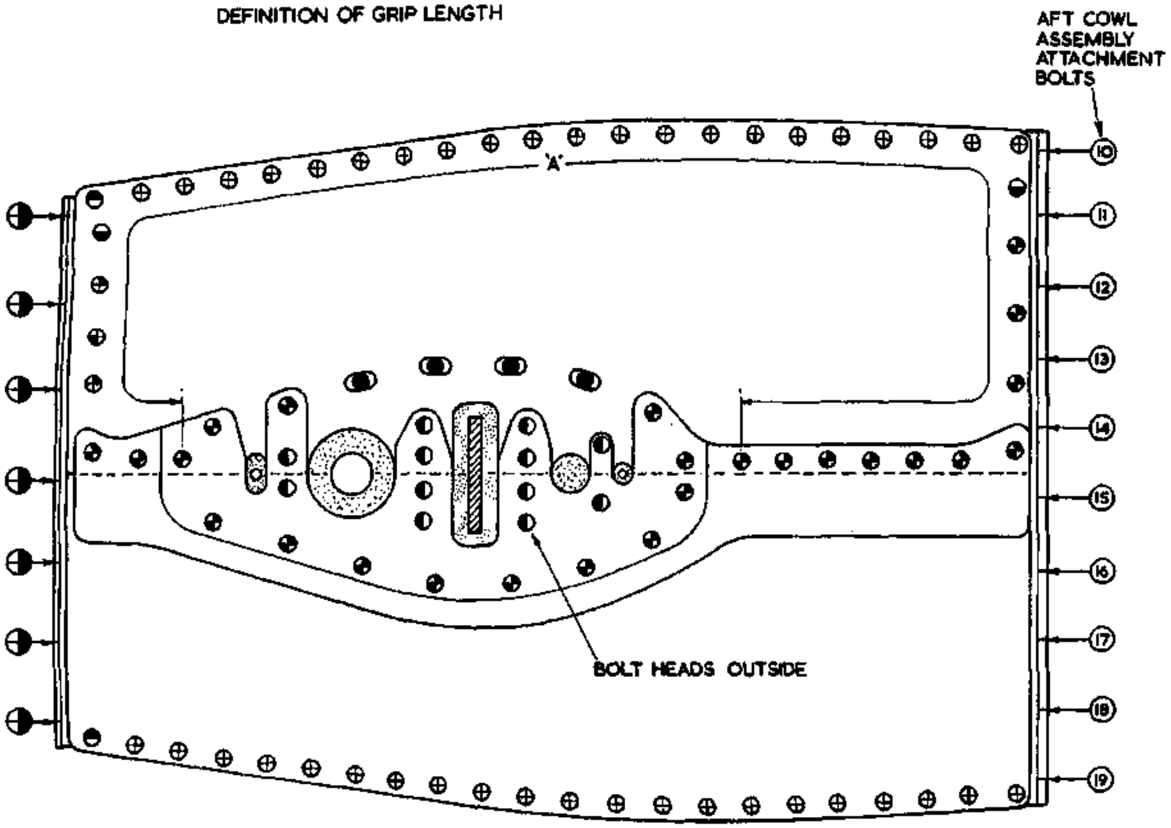


Engine rear mount fairings

*Figure 403*



DEFINITION OF GRIP LENGTH



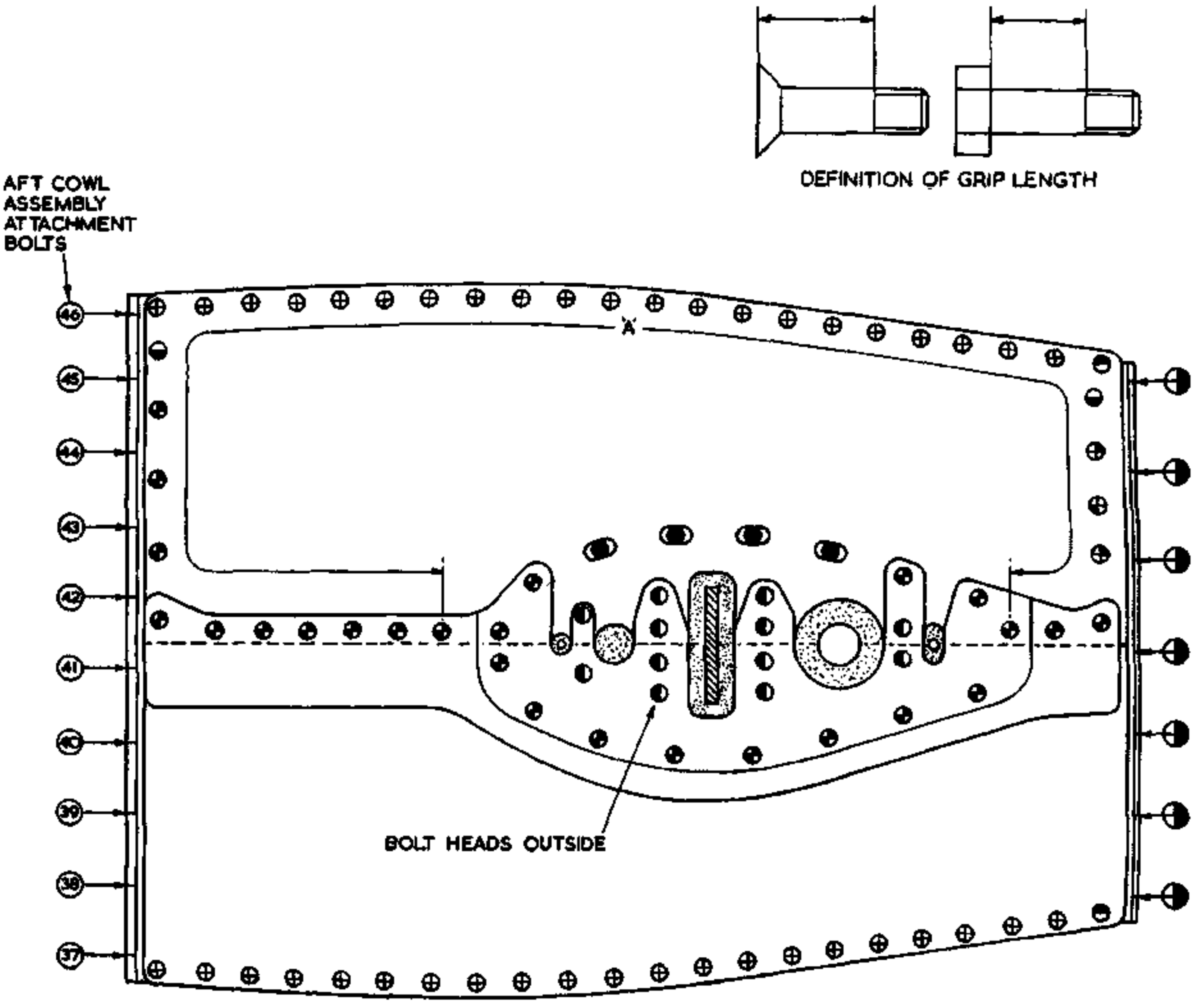
- ● SCREW-CSK-10-32 UNF x 0.18 IN
- ⊖ SCREW-CSK-10-32 UNF x 0.23 IN + THIN WASHER + LOCKNUT
- ⊕ SCREW-CSK-10-32 UNF x 0.23 IN + WASHER 0.063IN THICK + LOCKNUT
- ⊕ SCREW-CSK-10-32 UNF x 0.23 IN + LOCKNUT
- ◕ SCREW-CSK-10-32 UNF x 0.23 IN
- ◐ BOLT-HEX HD-10 UNF 2A x 0.50 IN + LOCKNUT
- ⊕ BOLT-HEX HD-10-32UNF x 0.250 IN + THIN WASHER
- ⊖ BOLT-HEX HD-10-32UNF x 0.312 IN + THIN WASHER
- ◑ BOLT-HEX HD-10-32UNF x 0.125 IN

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

**NOTE**
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

V1036
HA008989067AA

Engine rear mount fairing attachments - left engine
*Figure 404 (Sheet 1 of 2)*



NOTE
SINCE BOLTS OF THREE DIFFERENT STANDARDS ARE USED FOR ATTACHMENT PURPOSES, IT IS ESSENTIAL THAT THEY ARE IDENTIFIED TO THE POSITIONS THEY OCCUPY

● SCREW-CSK-10-32UNF x 0.18 IN
⊖ SCREW-CSK-10-32UNF x 0.23IN + THIN WASHER + LOCKNUT
⊕ SCREW-CSK-10-32UNF x 0.23IN + WASHER 0.063IN THICK + LOCKNUT
⊕ SCREW-CSK 10-32UNF x 0.23IN + LOCKNUT
◕ SCREW-CSK-10-32UNF x 0.23 IN
◐ BOLT-HEX HD-10UNF 2A x 0.50 IN + LOCKNUT
⊕ BOLT-HEX HD-10-32UNF x 0.250IN + THIN WASHER
⊖ BOLT-HEX HD-10-32UNF x 0.312IN + THIN WASHER
⊕ BOLT-HEX HD-10-32UNF x 0.125IN

BOLT/SCREW DIMENSION = GRIP LENGTH OR UNTHREADED PORTION OF BOLT

V1037
HA00B98906SAA

Engine rear mount fairing attachments - right engine

*Figure 404 (Sheet 2 of 2)*

(9) Disconnect N1 services at the pylon/power plant interface *(Figure 405).*

(a) Remove four bolts securing the terminal cover.

(b) Loosen locknuts. Disconnect N1 monopole connector plug coded TV1 (left engine) or TW1 (right engine).

(10) Unclip N1 services.

(a) Lift N1 monopole cable clear of the rear cut-out in the lower panel assembly at the rear engine mount.

(b) Unclip N1 cable at the engine hot end *(Figure 406).*

**CAUTION: WHEN MANIPULATING THE N1 CABLE AVOID EXCESSIVE BENDING AND KINKING.**

**C. Group 1 - Close up**

| Equipment/Material | Part/Item No. |
|---|---|
| Torque wrench capable of (lbf/in.) 45 | |

(1) Self-locking nuts - check run down torque manually.

(a) Attempt to screw self-locking nut on to the bolt beyond the self-locking section using maximum finger pressure. If the nut can be screwed beyond the self-locking section reject it.

(b) Obtain a new nut and repeat the check.

(2) Install exhaust pipe and tube assembly.

(a) Position and locate exhaust pipe complete with exhaust tube to the thrust and exhaust nozzle, making sure that the integral dowel pin correctly seats in the mating hole in the exhaust nozzle flange.

(b) Install the two halves of the exhaust pipe clamp, joining them with their T-bolts. Screw on the high temperature nuts an equal amount on each bolt.

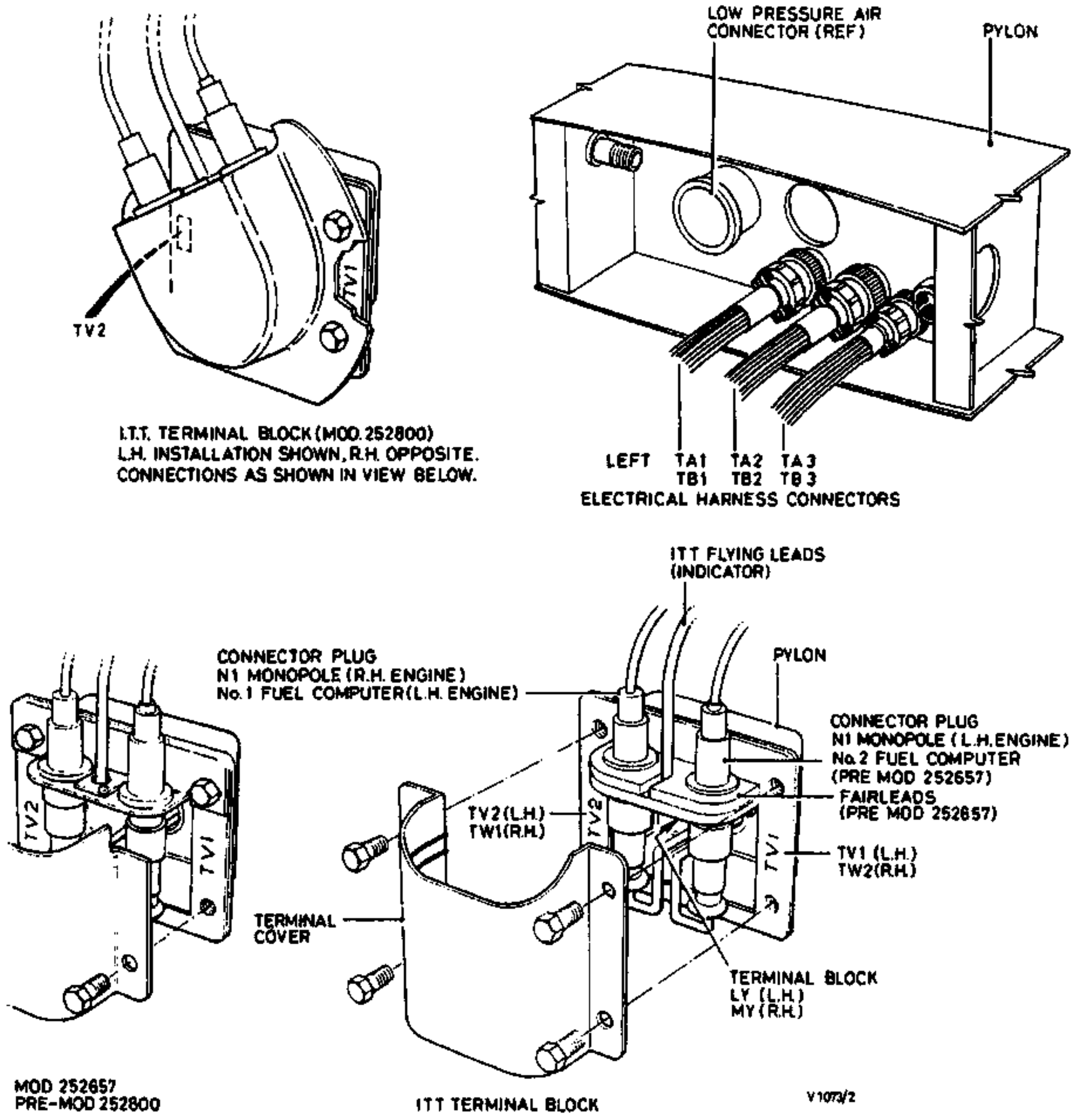
(c) Torque tighten the nuts to 45 lbf/in.. Lightly tap the circumference of the clamp halves with a non-metallic mallet. Check and retorque the nuts.

(d) Repeat the bedding down process using the mallet then retorque the nuts.

(3) Install the fan exhaust duct top and bottom inner skins *(Figure 402).*

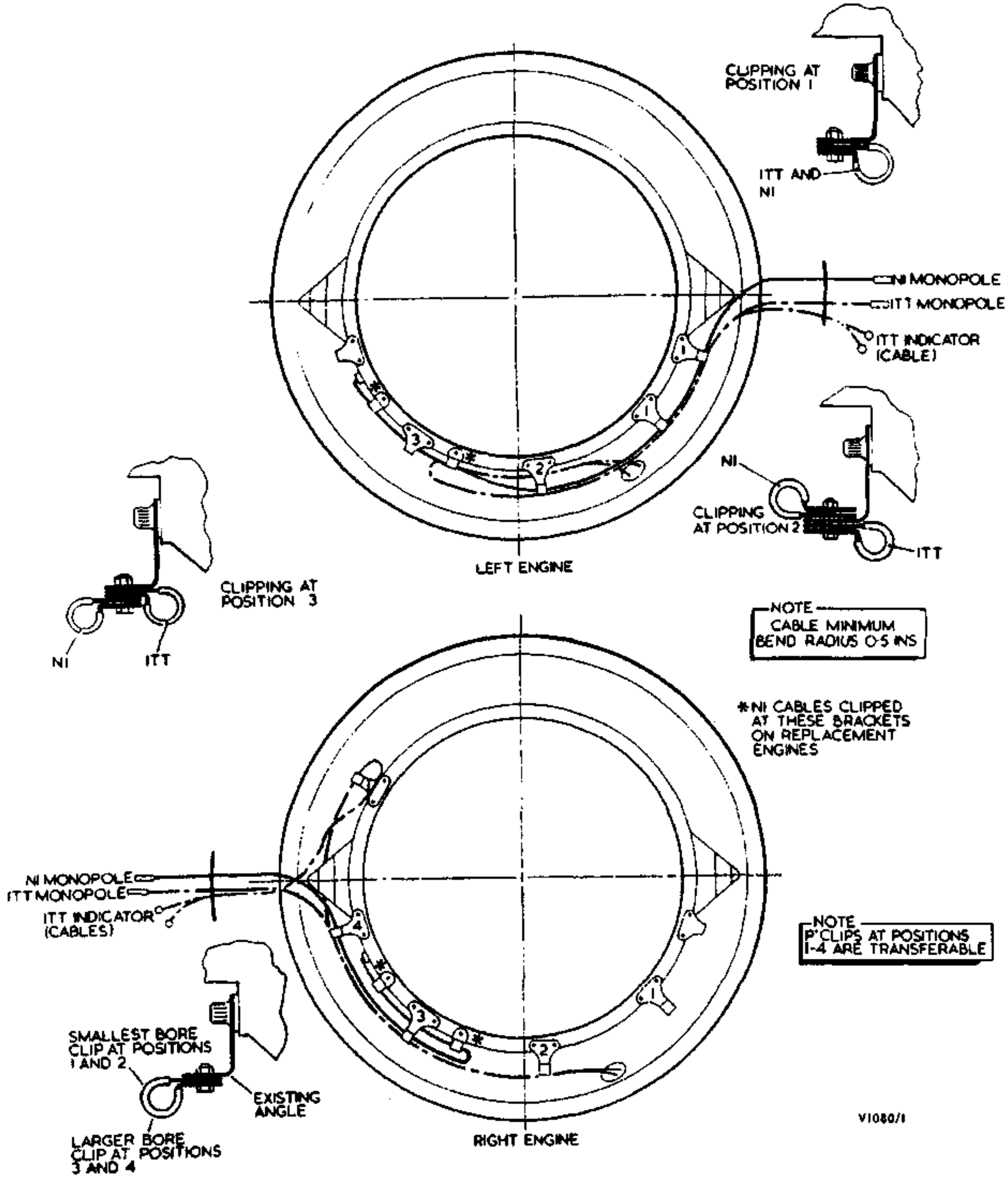
*NOTE: Tighten all screws progressively round the forward periphery.*

(a) Position and support the bottom panel making sure that it seats correctly on the engine rear mount lower fairing avoiding contact with the fire detection system sensor.


TV2
TV1
I.T.T. TERMINAL BLOCK (MOD. 252800)
L.H. INSTALLATION SHOWN, R.H. OPPOSITE.
CONNECTIONS AS SHOWN IN VIEW BELOW.
LOW PRESSURE AIR CONNECTOR (REF)
PYLON
LEFT TA1 TB1 TA2 TB2 TA3 TB3
ELECTRICAL HARNESS CONNECTORS
ITT FLYING LEADS (INDICATOR)
CONNECTOR PLUG N1 MONOPOLE (R.H. ENGINE) No. 1 FUEL COMPUTER (L.H. ENGINE)
PYLON
CONNECTOR PLUG N1 MONOPOLE (L.H. ENGINE) No. 2 FUEL COMPUTER (PRE MOD 252657)
FAIRLEADS (PRE MOD 252657)
TV2 (L.H.) TW1 (R.H.)
TV1 (L.H.) TW2 (R.H.)
TERMINAL COVER
TERMINAL BLOCK LY (L.H.) MY (R.H.)
TV2
TV1
MOD 252657
PRE-MOD 252800
ITT TERMINAL BLOCK
V1073/2

Power plant services connections details - electrical

*Figure 405*



Clipping of N1 and ITT services

*Figure 406*

(b) Attach panel at forward periphery using screws and washers and tighten all screws.

(c) Lay top panel in position making sure that it seats correctly on the engine rear mount upper fairing.

(d) Attach the panel at the forward periphery and horizontal joints using screws and washers and tighten all screws.

(e) When located and secure, make sure top and bottom panels fit snugly around the exhaust tube assembly. Make sure all air holes and slots are unobstructed.

(f) Install front fairing at the high pressure air bleed pipe using screws/bolts and washers; tighten screws/bolts.

(4) Install aft cowl assembly *(Figure 401 and Figure 407)*.

(a) Position aft cowl assembly making sure that its attachment holes align with their counterparts in the engine flange and with the vacant holes in the upper panel and lower panel assembly at the rear engine mount.

(b) Left engine - Install cowl attachment bolts and nuts *(Figure 407)*.

| | |
|---|---|
| 1-9 | |
| 10-14 | Already installed. |
| 15-18 | Remember to connect Teleflex attachment brackets. |
| 19 | Already installed. |
| 20-21 | Remember to connect TA1/TA3 harness clip No.2 bracket. |
| 23-24 | |
| 25-26 | Remember to connect Teleflex attachment bracket. |
| 27-54 | |

(c) Tighten all attachment nuts.

(d) Right engine - Install cowl attachment bolts and nuts *(Figure 407)*.

| | |
|---|---|
| 1-21 | |
| 22-23 | Remember to connect TB1/TB3 harness clip No.13 bracket. |
| 24-37 | |
| 38-41 | Remember to connect Teleflex attachment bracket. |
| 42-47 | Already installed. |
| 45-54 | |

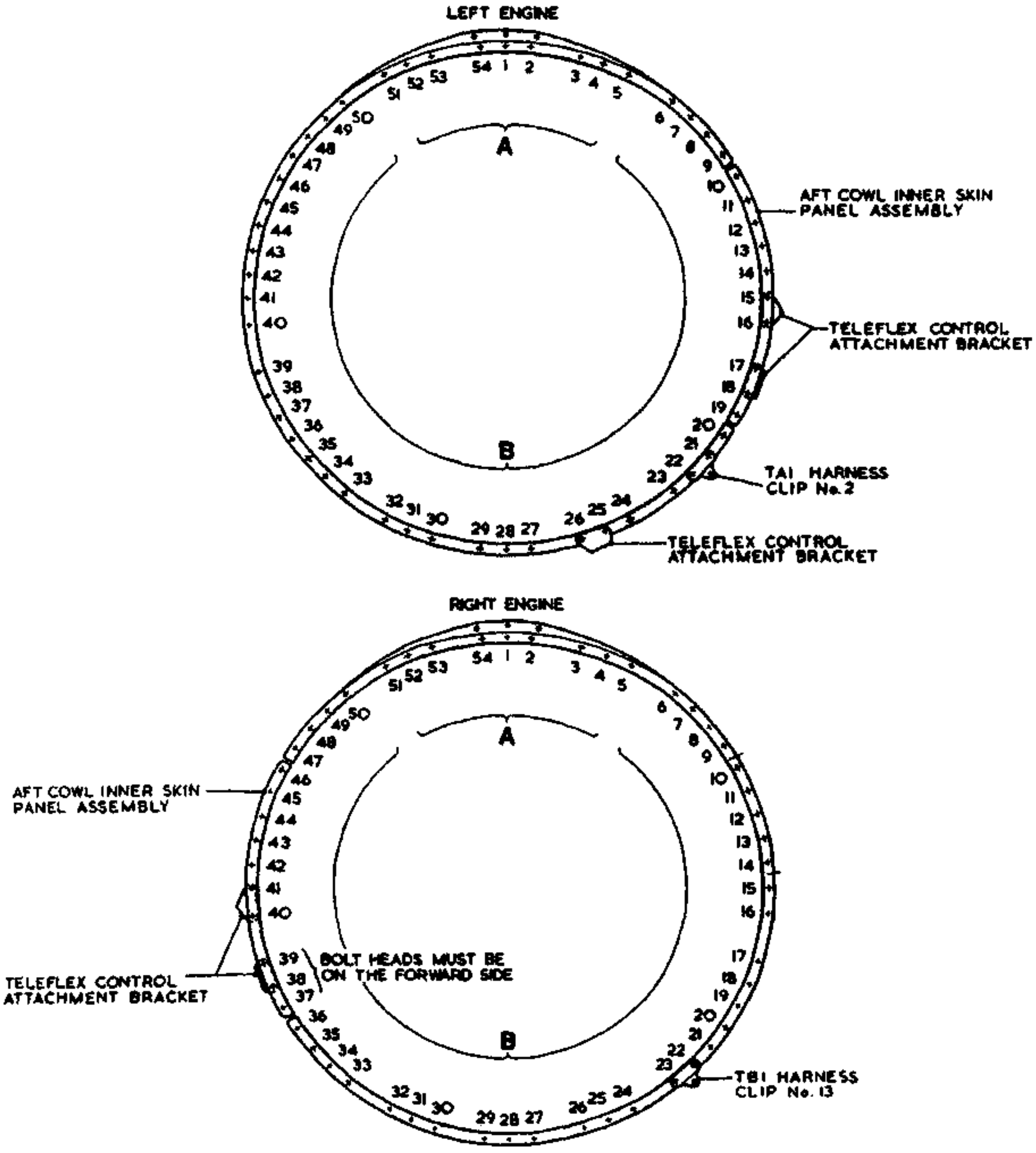
(e) Tighten all attachment nuts.

(f) Reclip electrical leads and pipes to the cowl forward diaphragm.

(g) Install the exhaust pipe cover.

(h) Install bolts from aide-memoire panel to the horizontal edges, aft edge and angle of the upper panel and lower panel assembly.

(i) Install aft cowl assembly top and bottom outer closing panels at the engine rear mount.



BOLT LOCATIONS (LOOKING FORWARD)

| HOLE REFERENCE No | BOLT | |
|---|---|---|
| | DIA | GRIP LENGTH |
| A {1 – 5<br>51 – 54} | 10/32 UNF | 0.562 IN |
| B 6 – 50 | 10/32 UNF | 0.312 IN |

WASHERS FITTED TO ALL BOLTS

V764/1

Aft cowl attachment

*Figure 407*

(5) Install engine rear mount access panels to pylon top and bottom surfaces.

(6) Install upper panel.

  (a) Locate upper panel on the engine taking care that its hinge bars do not damage local electrical cables or looms.

  (b) Align bolt holes (3 off) at the forward edge of the panel and install securing bolts but do not tighten at this stage.

  (c) Align panel shear pins (2 off) with their housing assemblies on the aft cowl and close shear pin latches.

  (d) Tighten panel securing bolts installed in paragraph (b).

(7) Install lower access door.

  (a) Position lower access door up to the hinge bars on the upper panel. Close hinge latches and make sure they seat flush.

  (b) Close the door, push in the latches and make sure they seat flush.

  (c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (refer to Chapter 71-10-00, SERVICING).*

### D. Group 1 - Adjustment/test

(1) Ground test the engine - refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

## 2. Group 2 - Procedure

### A. Group 2 - sub-assemblies and components *(Refer to Allied Signal, Light Maintenance Manual)*

| | |
|---|---|
| (1) Transducer N2 | Chapter 77-10-05. |

### B. Group 2 - access procedures

(1) Open lower access door.

  (a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot and lever outboard to release.

  (b) Open the door and stabilize open using the door strut.

### C. Group 2 - close up

(1) Close lower access door.

  (a) Release and stow the door strut.

  (b) Close the door, push in the latches and check they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (refer to Chapter 71-10-00, SERVICING).*

**D. Group 2 - adjustment/test**

(1) Ground test the engine - refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

## 3. Group 3 Procedure

**A. Group 3 - sub-assemblies and components** *(Refer to Allied Signal, Light Maintenance Manual)*

| | |
|---|---|
| (1) Harness - Thermocouple (ITT) | Chapter 77-20-01. |

**B. Group 3 - access procedure**

| Equipment/Material | Part/Item No. |
|---|---|
| Jury strut | 25-7Y-27A or locally manufactured equivalent |

*NOTE: Due to the complexity of the bolt-up arrangement at the engine rear mount fairing and the necessity for correct identification of bolts, washers and nuts during disassembly and assembly, it is recommended that an aide-memoire panel for storage of bolts etc. be locally manufactured. The panel can be made from thin metal sheet or plywood using the layout given by Figure 404 Sheet 1 suitably enlarged. Drill the holes using a 4.9mm diameter drill and stencil LH on the obverse face and RH on the reverse face.*

(1) Remove lower access door.

(a) At the inboard latches on the door; insert a short screwdriver (approximately three inches long) into each facia slot and lever outboard to release. Open the access door.

(b) With the door adequately supported and, at each outboard hinge in turn, insert a suitable 0.25 in. diameter rod into each facia hole and lever outboard to release. Remove access door.

(2) Remove upper panel.

(a) At the rear edge of the panel insert a suitable 0.25 in. diameter rod into the facia hole of each shear pin latch and lever outboard to release.

(b) At the forward edge of the upper panel, remove three countersunk bolts securing the panel to the inlet cowl. Carefully remove the panel making sure that its hinge bars (3) do not damage local electrical cables or looms.

(3) Isolate pertinent electrical power supplies by removing fuses and/or opening circuit breakers (refer to Table 401).

(4) Remove engine rear mount access panels from pylon top and bottom surfaces *(Figure 401)*.

(5) Remove aft cowl assembly *(Figure 401)*.

(a) Remove the top and bottom outer closing panels from aft cowl assembly.

(b) Remove the bolts etc. from the longitudinal edges of the upper panel and lower panel assembly and cowl inner skin. Stow bolts in the aide-memoire panel.

(c) Remove bolts etc. connecting the rear angle at the aft cowl inner skin. Stow bolts in the aide-memoire panel.

*NOTE: The upper panel and lower panel assembly remain connected to the engine flange at this stage.*

(d) Disconnect electrical leads and pipes from their P-clips on the cowl forward diaphragm.

(e) Support aft cowl assembly then remove nuts, washers and bolts from the cowl/engine fan exhaust duct flange (except at attachment locations 10-19 (left engine) or 37-46 (right engine).

(f) Withdraw cowl assembly rearwards and remove from the aircraft.

(6) Remove fan exhaust duct inner top and bottom skins *(Figure 402)*.

(a) Remove screws and washers securing the high pressure air bleed pipe fairing to top panel and remove fairing.

(b) Remove screws and washers from top panel forward periphery and longitudinal lap joints and remove top panel.

(c) Support bottom panel, remove screws and washers at forward periphery and remove bottom panel.

(7) Remove exhaust tube assembly.

(a) Support exhaust tube assembly.

(b) Unscrew the exhaust tube clamp T-bolts self-locking high temperature nuts. Remove clamp halves and withdraw the exhaust tube assembly rearwards.

(8) Dismantle engine rear mount fairing *(Figure 403 and Figure 404)*.

(a) Remove bolts and washers (6 off) securing the upper fairing to the lower fairing.

(b) Remove bolts etc. securing upper fairing to upper panel and remove upper fairing. Stow bolts etc. in the aide-memoire panel.

(c) Remove remaining bolts securing upper panel to lower panel assembly, remove upper panel. Stow bolts etc. in the aide-memoire panel.

(d) Remove bolts etc. from matching half shields and seals. Stow bolts etc. in the aide-memoire panel. Remove matching half shields and seals.

(9) Disconnect thermocouple harness (ITT) and N1 services at the pylon/power plant interface *(Figure 405)*.

(a) Remove four bolts securing the terminal cover and remove cover.

(b) Loosen locknuts, disconnect ITT computer plug coded TV2 (left engine) or TW2 (right engine).

(c) Loosen locknuts, disconnect N1 monopole connector plug codedTV1 (left engine) or TW1 (right engine).

(d) Pre-Mod 252657. Remove fairleads and tie up locally.

(e) Remove cover from terminal block coded LY (left engine) or MY (right engine) and disconnect ITT indicator leads. Post-Mod 252657 pull the leads through the mounting bracket.

(10) Unclip ITT harness and N1 services.

(a) Lift ITT harness and N1 cable clear of the rear cut-out in the lower panel assembly at the engine rear mount.

(b) Unclip ITT harness and N1 cable at the engine hot end *(Figure 406)*.

**CAUTION: WHEN MANIPULATING THE ITT/N1 CABLES AVOID EXCESSIVE BENDING AND KINKING.**

(11) After dismantling the low pressure turbine retention facilities, disconnect the engine rear mount.

(a) At the rear mount attachment bolt, extract and discard the split pin.

(b) Remove slotted nut and washer/s and retain these parts.

(c) Remove rear mount attachment bolt retaining the washer/s under the bolt head.

**CAUTION: IMMEDIATELY AFTER REMOVAL OF THE THRUST AND EXHAUST NOZZLE/ TURBINE INTERSTAGE TRANSITION DUCT MODULE, COMPLETE WITH THERMOCOUPLE HARNESS, IT IS ESSENTIAL THAT THE REAR END OF THE ENGINE BE STABILIZED IN YAW BY INSTALLATION OF THE JURY STRUT (REFER TO EQUIPMENT/SPECIAL TOOLS). THE STRUT SHALL BE CONNECTED TO THE TRANSITION DUCT ATTACHMENT FLANGE BY NOT LESS THAN EIGHT SERVICE BOLTS AND TO THE ENGINE REAR MOUNT ON THE PYLON.**

### C. Group 3 - close up

| Equipment/Material | Part/Item No. |
|---|---|
| Torque wrench capable of (lbf/in.) | 45<br>60-85 |

Materials and Parts required

| Materials | Application |
|---|---|
| DTD 5617 or Optimoly Paste PL or Moly-Paul GP 109 or Rocol MT-LM or any grease quoted in the Allied Signal, Light Maintenance Manual, Report No. 72-02-15. | Engine mount bolt |

Parts required

| Nomenclature | Part No. | Location | Qty |
|---|---|---|---|
| Split pin | SP90C8 | Engine rear mount | 1 |

General

(1) Self-locking nuts.

(a) Check run down torque manually.

Attempt to screw self-locking nut to the bolt beyond the self-locking section using maximum finger pressure. If the nut can be screwed beyond the self-locking section, reject it. Obtain a new nut and repeat check.

Close up

(2) Connect engine rear mount.

(a) Lubricate engine rear mount attachment bolt (refer to Materials).

(b) Insert bolt (with washer/s under head as removed) from the rear.

(c) Install remaining washer/s (as removed) and slotted nut.

(d) Torque tighten slotted nut to 60-85 lbf/in. making sure that one slot in the nut aligns with the split pin hole in the bolt.

(e) Make sure that there is not less than 0.015 in. clearance between the threaded end of the bolt and engine casing.

(f) Install and lock a new split pin.

(3) Connect and clip up ITT harness and N1 services *(Figure 405).*

(a) Lay ITT harness and N1 cable across the rear cut-out in the lower panel assembly at the engine rear mount.

(b) Connect the ITT indicator cable red sleeve idented lead to terminal LY2 of terminal block LY (left engine) and the yellow sleeved lead to terminal LY1 or the red sleeved lead to terminal MY2 of terminal block MY (right engine) and the yellow sleeved lead to terminal MY1, i.e., engine red sleeved lead to aircraft blue sleeved lead and engine yellow sleeved lead to engine red sleeved lead.

*NOTE: If the engine installed does not incorporate a shortened ITT cable, refer to Chapter 77-21-00, SERVICING for the method of shortening the cable if adequate facilities exist at the location of the engine change. If such facilities do not exist, connect up at the terminal block, tape up surplus cable into a coil making sure that it is clear of hot parts and defer cable shortening until return to base. Post-Mod 252657 only. It will be necessary to pass the cable through a hole in the fairlead before connecting up.*

(c) Pre-Mod 252657 only. Install fairleads.

(d) Connect N1 monopole connector plug coded TV1 (left engine) or TW1 (right engine).

(e) Connect ITT computer plug coded TV2 (left engine) or TW2 (right engine).

(f) Pull cables/leads straight without tension and clip up cables/leads at the engine hot end *(Figure 406).*

**CAUTION: MINIMUM BEND RADIUS OF CABLES TO BE NOT LESS THAT 0.50 IN.**

(4) Install engine rear mount fairings *(Figure 403 and Figure 404).*

(a) Connect upper panel to lower panel assembly using the pertinent bolts, washers and nuts from the aide-memoire panel and tighten bolts (17 off).

(b) Install two matching half-shields in opposition to abut the upper panel and lower panel assembly.

(c) Install seals, one with assembly slots lowermost and one with assembly slots uppermost, making sure that the ITT/N1 cables/leads and the slotted bush on the fire detection system sensor seat correctly.

(d) Install the remaining pair of matching half-shields in opposition Bolt up the matching half-shields and seals (12 bolts) using bolts from the aide-memoire panel.

*NOTE: Do not overtighten these bolts.*

(e) Install upper fairing (9 bolts) using bolts from the aide-memoire panel.

(f) Connect upper fairing to the lower fairing (6 bolts).

(5) Install exhaust pipe and tube assembly.

(a) Position and locate exhaust pipe/tube assembly to the thrust and exhaust nozzle on the engine, making sure that the integral dowel pin correctly seats in the mating hole in the exhaust nozzle flange.

(b) Install the two halves of the exhaust pipe clamp, joining them with their T-bolts. Screw on the high temperature nuts an equal amount on each bolt.

(c) Torque tighten the nuts to 45 lbf/in., lightly tap the circumference of the clamp halves with a non-metallic mallet. Check and retorque the nuts.

(d) Repeat the bedding down process and retorque the nuts.

(6) Install fan exhaust duct top and bottom inner skin panels *(Figure 402)*.

*NOTE: Tighten all screws progressively round the forward periphery of the panels.*

(a) Position and support the bottom panel making sure that it seats correctly on the engine rear mount lower fairing avoiding contact with fire detection system sensor.

(b) Attach the panel at its forward periphery using screws and washers. Tighten all screws.

(c) Lay top panel in position ensuring that it seats correctly on the engine rear mount upper fairing.

(d) Attach panel at forward periphery and horizontal joints using screws and washers. Tighten all screws and washers.

(e) When located and secured, make sure top and bottom panels fit snugly around the exhaust tube assembly, making sure that all air holes and slots are unobstructed.

(f) Install front fairing at the high pressure air bleed pipe using screws/bolts and washers.

(7) Install aft cowl assembly *(Figure 401 and Figure 407)*.

(a) Position aft cowl assembly making sure that its attachment holes align with the holes in the engine flange and with the vacant holes in the upper panel and lower panel assembly at the engine rear mount.

(b) Left engine - Install cowl attachment bolts, washers and nuts *(Figure 407)*.

| | |
|---|---|
| 1-9 | |
| 10-14 | Already installed. |
| 15-18 | Remember to connect Teleflex attachment brackets. |
| 19 | Already installed. |
| 21-22 | Remember to connect TA1/TA3 harness clip No.2 bracket. |
| 23-24 | |
| 25-26 | Remember to connect Teleflex attachment bracket. |
| 27-54 | |

(c) Right engine - Install cowl attachment bolts, washers and nuts *(Figure 407)*.

| | |
|---|---|
| 1-21 | |
| 22-23 | Remember to connect TB1/TB3 harness clip No.13 bracket. |
| 24-37 | |
| 38-41 | Remember to connect Teleflex attachment brackets. |
| 42-47 | Already installed. |
| 48-54 | |

(d) Tighten all bolts.

(e) Install remaining bolts from aide-memoire panel to the horizontal edges and aft edge and angle of the upper panel and lower panel assembly.

(f) Install exhaust pipe blank.

(g) Install aft cowl assembly top and bottom outer closing panels at the engine rear mount.

(8) Install engine rear mount access panels to the pylon top and bottom surfaces.

(9) Install upper panel.

(a) Locate panel on the engine making sure that its hinge bars do not damage local electrical cables or looms.

(b) Align bolt holes (3 off) at the forward edge of the panel. Install countersunk securing bolts but do not tighten at this stage.

(c) Align the shear pins (2 off) with their housing assemblies on the aft cowl forward diaphragm. Close the shear pin latches.

(d) Tighten the panel securing bolts installed in paragraph (b).

(10) Install lower access door.

(a) Position the door up to the hinge bars on the upper panel. Close the hinge latches and make sure they seat flush.

(b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50% renew the seal (refer to Chapter 71-10-00, SERVICING).*

(11) Restore electrical supplies by installing fuses and/or closing circuit breakers (refer to Table 401).

### D. Group 3 - adjustment/test

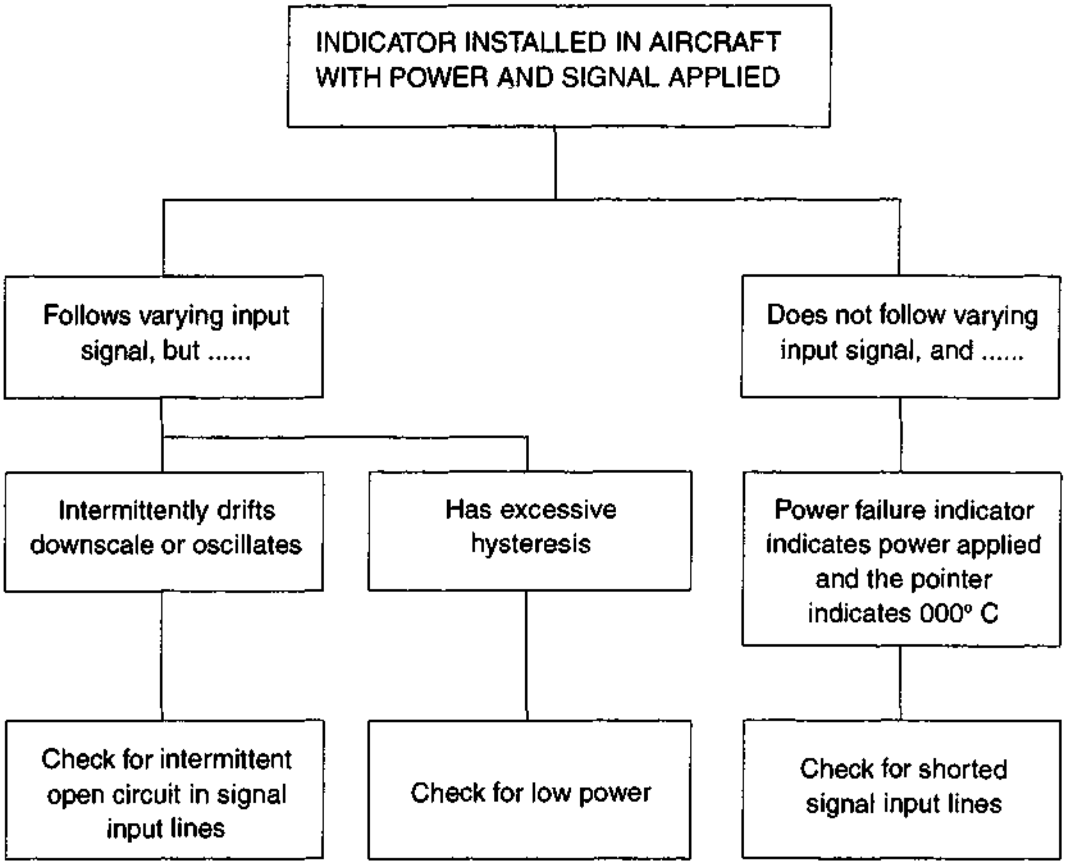
(1) Ground test the engine - refer to Chapter 71-00-00, POWERPLANT - ADJUSTMENT/TEST.

**Table 401 (Series F400)**
**ENGINES - POWER SUPPLIES**

| Circuit | | Sub-panel D - circuit breaker | Sub-panel E - circuit breaker | Panel ZK - fuse | Panel ZL - fuse |
|---|---|---|---|---|---|
| Fuel filter | Left<br>Right | -<br>- | -<br>- | -<br>- | F16<br>F17 |
| Fuel temperature | Left<br>Right | -<br>- | -<br>- | -<br>- | F18<br>F19 |
| Oil low pressure | Left<br>Right | -<br>- | -<br>- | -<br>- | F21<br>F22 |
| Oil temperature | Left<br>Right | -<br>- | B21<br>B22 | -<br>- | -<br>- |
| Oil pressure | Left<br>Right | B15<br>B16 | -<br>- | -<br>- | -<br>- |
| Fuel flowmeter | Left<br>Right | -<br>- | -<br>- | F38, F39<br>F38, F48 | -<br>- |
| Fire detection | Left<br>Right | -<br>B22 | -<br>- | -<br>- | F12<br>F11 |
| Engine/intake de-ice | Left<br>Right | B50<br>B51 | -<br>- | F24<br>F25 | -<br>- |
| Engine r.p.m. | Left<br>Right | -<br>- | -<br>- | F34, F35, F44, F45<br>F29, F30, F54, F55 | -<br>- |
| I.T.T. | Left<br>Right | -<br>- | -<br>- | øF28, F42*<br>*F27, F47*, | -<br>- |
| Ignition | Left<br>Right | -<br>- | -<br>- | -<br>- | F5<br>F6 |
| No.1 fuel computer | | - | - | F10, F31 | - |
| No.2 fuel computer | | - | - | F11, F20, F32 | - |

ø Pre and Mod.252835
* Mod.252835

# INTER STAGE TURBINE TEMPERATURE (I.T.T.) INDICATION TROUBLE SHOOTING


INDICATOR INSTALLED IN AIRCRAFT WITH POWER AND SIGNAL APPLIED
Follows varying input signal, but ......
Does not follow varying input signal, and ......
Intermittently drifts downscale or oscillates
Has excessive hysteresis
Power failure indicator indicates power applied and the pointer indicates 000° C
Check for intermittent open circuit in signal input lines
Check for low power
Check for shorted signal input lines

# INTERSTAGE TURBINE TEMPERATURE (ITT) INDICATION SERVICING

## 1. ITT indicator cable leads on engine

| Equipment/Material | Part/Item No. |
|---|---|
| Crimping tool | 46673-8 |
| Sealing compound | 317 or 380 (Chapter 20-95-301) |
| Terminal (grey) (Chromel conductor) | 1-321897-3 |
| Terminal (green) (Alumel conductor) | 1-321898-0 |

### A. General

(1) On engines installed during aircraft build, the ITT indicator twin core screened cable from the ITT sensors on the engine was cut back approximately 13.5 in., re-identified, retagged and sealed before connection with terminal block coded LY (left engine) or MY (right engine). Such engines sent to Garrett AiResearch for repair will be returned to the operator in that condition.

(2) New engines delivered from Garrett AiResearch to an operator will incorporate a shortened cable.

(3) Should the engine installed have been converted from a model TFE731-3-1F to a TFE731-3-1H or TFE731-3R-1H standard, it will incorporate a standard cable. This should be shortened as in paragraph B.

### B. Shorten an ITT indicator lead with engine installed

(1) Cut back the cable approximately 13.5 in. measured from the terminal end.

(2) Strip back the cable outer sheath by 1.75 in. to expose the braided screen.

(3) Carefully trim off 1.25 in. of braided screen leaving 0.50 in.. Roll this back on the outer sheath.

(4) Cut back each conductor insulation by 0.37 in.

(5) Remove the red and yellow ident sleeves from the redundant cable leads and transfer them to the engine cable leads. Assemble the yellow sleeve to the Chromel conductor and the red sleeve to the Alumel conductor.

*NOTE: If any doubt exists as to the function of each conductor the bared end of the Chromel conductor will not react to a magnet whereas the Alumel conductor will be attracted. Use new ident sleeves if the existing ones are unserviceable or cannot be removed from the redundant cable leads.*

(6) Using a crimping tool, attach a new terminal to the Chromel conductor and to the Alumel conductor making sure that each conductor protrudes 0.020 in. on to the respective terminal palm.

(7) Seal around each conductor at its emergence from the outer sheath to prevent the ingress of moisture. Extend sealant on to the rolled back braided screen making sure there are no voids in the sealing compound.

# INTERSTAGE TURBINE TEMPERATURE (I.T.T.) INDICATION ADJUSTMENT/TEST

## 1. Test continuity resistance of ITT circuit

| Equipment/Material | Part/Item No. |
|---|---|
| Precision Wheatstone bridge | – |

*NOTE: Engine must be at ambient temperature before proceeding with this test.*

(1) Disconnect electrical plug from adapter on rear of interstage turbine temperature (ITT) indicator.

(2) Connect the leads from a Wheatstone bridge to pins A & B of the electrical plug disconnected from the ITT indicator and note the resistance.

(3) Subtract the resistance of the bridge leads from the reading obtained in paragragh (2). The circuit resistance should be 25 ± 4 ohms.

(4) Remove test equipment.

(5) Connect electrical plug to adapter on rear of ITT indicator.

## 2. Test insulation resistance of ITT circuit

| Equipment/Material | Part/Item No. |
|---|---|
| 100 volt d.c. resistance tester | – |

*NOTE: Engine must be at ambient temperature before proceeding with this test.*

(1) Disconnect electrical plug from adapter on rear of ITT indicator.

**CAUTION: DO NOT APPLY MORE THAN 100 VOLTS.**

(2) Using the resistance tester, apply 100 volts between pin A and earth and pin B and earth of the plug disconnected from the ITT indicator making sure that resistance, in each case is at least 50 kilohms.

*NOTE: Low resistance may be caused by contamination of electrical connectors, if necessary clean connectors with an approved cleaning agent.*

(3) Disconnect test equipment.

(4) Connect electrical plug to adapter on rear of ITT indicator.

## 3. Calibrate system - Engine static

| Equipment/Material | Part/Item No. |
|---|---|
| Thermometer for measuring ambient air temperature | – |
| Standard d.c. potentiometer test set or compensated test set with appropriate accessories (Refer to test set manufacturer's manual for instructions in its use) | – |

*NOTE: Engine must be at ambient temperature before proceeding with this test.*

(1) Test continuity and insulation resistance of ITT circuit. Refer to paragraphs 1 and 2.

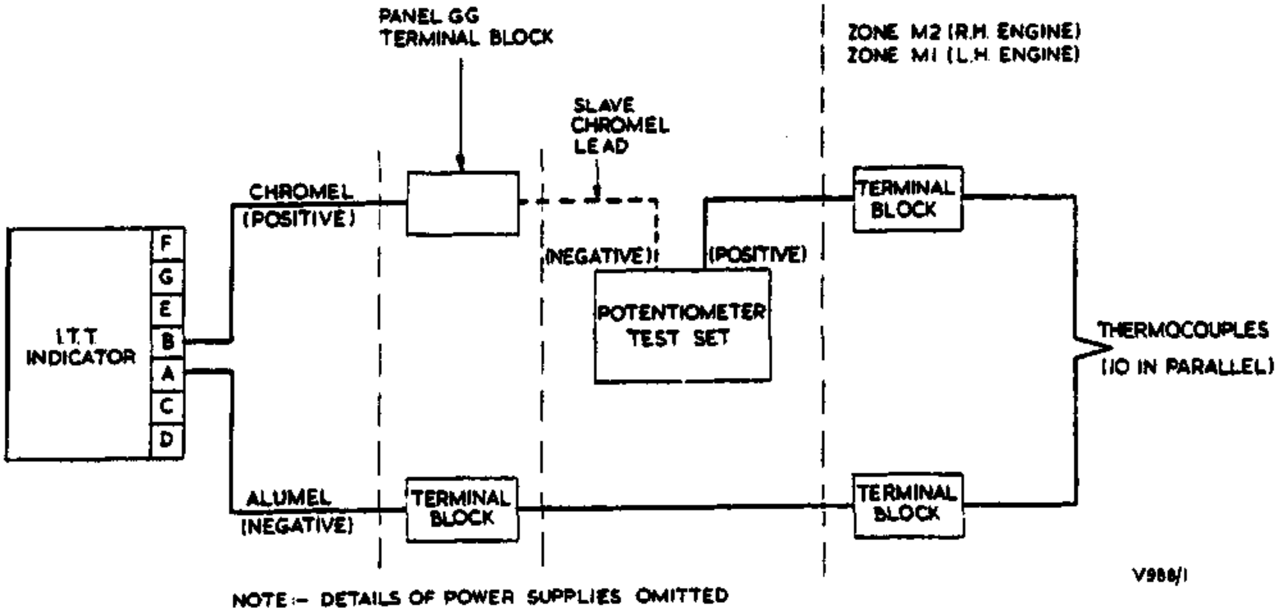
(2) Remove power supply fuses to the ITT indicating system (refer to Table 503 and Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(3) At panel GG, disconnect one chromel lead from the terminal block (*Figure 501* and Table 503).

(4) Connect a slave chromel lead to the appropriate terminal block.

**Table 501**

| Temperature (°C) | MV |
|---|---|
| 0 | 0.00 |
| 50 | 2.02 |
| 100 | 4.10 |
| 150 | 6.13 |
| 200 | 8.13 |
| 250 | 10.16 |
| 300 | 12.21 |
| 400 | 16.40 |
| 450 | 18.51 |
| 500 | 20.65 |
| 550 | 22.78 |
| 600 | 24.91 |
| 650 | 27.03 |
| 700 | 29.14 |
| 750 | 31.23 |
| 800 | 33.30 |
| 850 | 35.34 |
| 900 | 37.36 |
| 950 | 39.35 |
| 1000 | 41.31 |
| 1050 | 43.25 |
| 1100 | 45.16 |
| 1150 | 47.04 |
| 1200 | 48.89 |



Test circuit
*Figure 501*

*NOTE: The applied millivolts quoted are correct only when an ice cold junction is in the circuit. For ambient temperature corrections refer to Table 502.*

(5) Connect the free end of slave chromel lead to d.c. potentiometer test set *(Figure 501)* -ve terminal.

(6) Connect ITT circuit chromel lead (disconnected in paragragh 3) to d.c. potentiometer test set +ve terminal.

(7) Install fuse to normal supply relay coil.

(8) Make sure each ITT indicator power OFF flag is displayed.

(9) Energize d.c. busbars (Chapter 24, ELECTRICAL POWER - GENERAL).

(10) Select INVerter No.1 to START.

**Table 502**

To correct applied MV for ambient temperature.

(1) Take MV for appropriate cardinal e.g. 37.36 at 900° C

(2) Subtract MV for ambient temperature e.g. 0.80 at 20° C

36.56

Therefore 36.56 is applied MV corrected for 20° C ambient temperature.

| °C | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | °C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 0.00 | 0.04 | 0.08 | 0.12 | 0.16 | 0.20 | 0.24 | 0.28 | 0.32 | 0.36 | **0** |
| **10** | 0.40 | 0.44 | 0.48 | 0.52 | 0.56 | 0.60 | 0.64 | 0.68 | 0.72 | 0.76 | **10** |
| **20** | 0.80 | 0.84 | 0.88 | 0.92 | 0.96 | 1.00 | 1.04 | 1.08 | 1.12 | 1.16 | **20** |
| **30** | 1.20 | 1.24 | 1.28 | 1.32 | 1.36 | 1.40 | 1.44 | 1.49 | 1.53 | 1.57 | **30** |
| **40** | 1.61 | 1.65 | 1.69 | 1.73 | 1.77 | 1.81 | 1.85 | 1.90 | 1.94 | 1.98 | **40** |
| **50** | 2.02 | 2.06 | 2.10 | 2.14 | 2.18 | 2.23 | 2.27 | 2.31 | 2.35 | 2.39 | **50** |
| **60** | 2.43 | 2.47 | 2.51 | 2.56 | 2.60 | 2.64 | 2.68 | 2.72 | 2.76 | 2.80 | **60** |

(11) Check each ITT indicator:

(a) Power OFF flag is clear.

(b) Integral lighting is satisfactory.

(12) Install fuse to relay.

(13) Select INVerter No.1 to OFF.

(14) Make sure each ITT indicator power OFF flag is not displayed.

(15) Select INVertor No.1 to START.

(16) Allow system to stabilize for 15 minutes

(17) Measure ambient air shade temperature.

(18) Using d.c. potentiometer test set inject a signal equivalent, in turn, to each temperature given in Table 501, corrected for ambient temperature Table 502. Make sure that ITT indicator registers appropriate temperature ± 3° C, and returns to ambient temperature when input signal is removed.

(19) De-energize d.c. and a.c. busbars.

(20) Remove test equipment.

(21) At panel GG, reconnect ITT system chromel lead to terminal block, refer to Table 503 or 504.

(22) At next engine run, make sure the ITT indicating system functions satisfactorily.

## INTERSTAGE TURBINE TEMPERATURE INDICATING CIRCUIT DETAILS

**Table 503**

| Engine | Circuit | Supply | Panel | Fuse | Chromel lead T/B | |
|---|---|---|---|---|---|---|
| | | | | | Panel | T/B Ident |
| Left | Normal relay coil | XS2 | TP | F8 | GG | K9R |
| | Alternative system | PE2 | ZK | F28 | GG | K9R |
| Right | Normal relay coil | XS2 | TP | F8 | GG | K4R |
| | Alternative system | PE2 | ZK | F28 | GG | K4R |

**Table 504 (Mod.252835)**

| Engine | Circuit | Supply | Panel | Fuse | Chromel lead T/B | |
|---|---|---|---|---|---|---|
| | | | | | Panel | T/B Ident |
| Left | Normal relay coil | PS1 | ZK | F42 | GG | K9R |
| | Alternative system | PE2 | ZK | F28 | GG | K9R |
| Right | Normal relay coil | PE2 | ZK | F47 | GG | K4R |
| | Alternative system | PE2 | ZK | F27 | GG | K4R |

# CHAPTER

# 79

# OIL

# CHAPTER 79

# OIL

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# OIL
# SUB-ASSEMBLIES AND COMPONENTS REMOVAL/INSTALLATION

**CAUTION: MAINTAIN AN INVENTORY OF ALL TOOLS, STORES AND EQUIPMENT USED BY PERSONS ACTIVELY EMPLOYED ON, OR IN THE VICINITY OF, AN ENGINE. THE INGESTION OF SMALL OBJECTS SUCH AS SPLIT PINS MAY SERIOUSLY DAMAGE AN ENGINE. WHENEVER A PIPE OR OTHER SUCH COMPONENT IS REMOVED IMMEDIATELY INSTALL A CAP TO THE APERTURE.**

*NOTE: The procedure required to gain access to the Garrett AiResearch engine sub-assemblies and components, to permit their removal from an installed power plant is given below. Reference is also made to the pertinent Removal/Installation procedure given in the Allied Signal, Light Maintenance Manual, Report No. 72-02-15.*

## 1. Procedure

### A. Sub-assemblies and components *(Refer to Allied Signal, Light Maintenance Manual)*

| | |
|---|---|
| (1) *Oil filter and cover* | *Chapter 79-20-01.* |
| (2) Oil pump and chip detector installation | Chapter 79-20-02. |
| (3) Oil filter by-pass indicator valve | Chapter 79-30-01. |

### B. Access procedure

| Equipment/Material | Part/Item No. |
|---|---|
| Drip tray | – |

(1) Open lower access door.

  (a) At the inboard latches on the door, insert a short screwdriver (approximately three inches long) into each facia slot. Lever outboard to release.

  (b) Open the door and stabilize using the door strut.

(2) Place drip tray under engine.

### C. Close up

(1) Close lower access door.

  (a) Unlatch and stow the door strut.

  (b) Close the door, push in the latches and make sure they seat flush.

(c) Make sure the engine breather pipe seal on the inner face of the door does not obstruct the breather pipe outlet (0.625 in. i/d) by more than 50%.

*NOTE: Should an obstruction be in excess of 50%, renew the seal (refer to Chapter 71-10-00, SERVICING).*

**D. Adjustment/test**

(1) Ground test the engine - refer to Chapter 71-00-00, POWER PLANT - ADJUSTMENT/TEST.

(2) Examine around the oil filter and cover for signs of leaks.

(3) Examine around the oil pump and chip detector for signs of leaks.

(4) Examine around the oil filter by-pass indicator valve for signs of leaks.

# OIL - INDICATING
# DESCRIPTION AND OPERATION

## 1. General

Engine oil pressure and oil temperature indicating systems are provided *refer to Figure 1*.

## 2. Oil pressure indication

An oil pressure transmitter is tapped into the oil supply manifold for the planet gear of the engine and is electrically connected to an indicator showing oil pressure in pounds per square inch (psi).

The indicator, installed with integral lighting, has a single pointer moving around a dial face scaled in radial *lines in psi increments from 0 to 70 psi with color zones round the scale showing:*

25 to 38 psi - Amber
38 to 46 psi - Green
46 to 55 psi - Amber
Radial lines - Red.

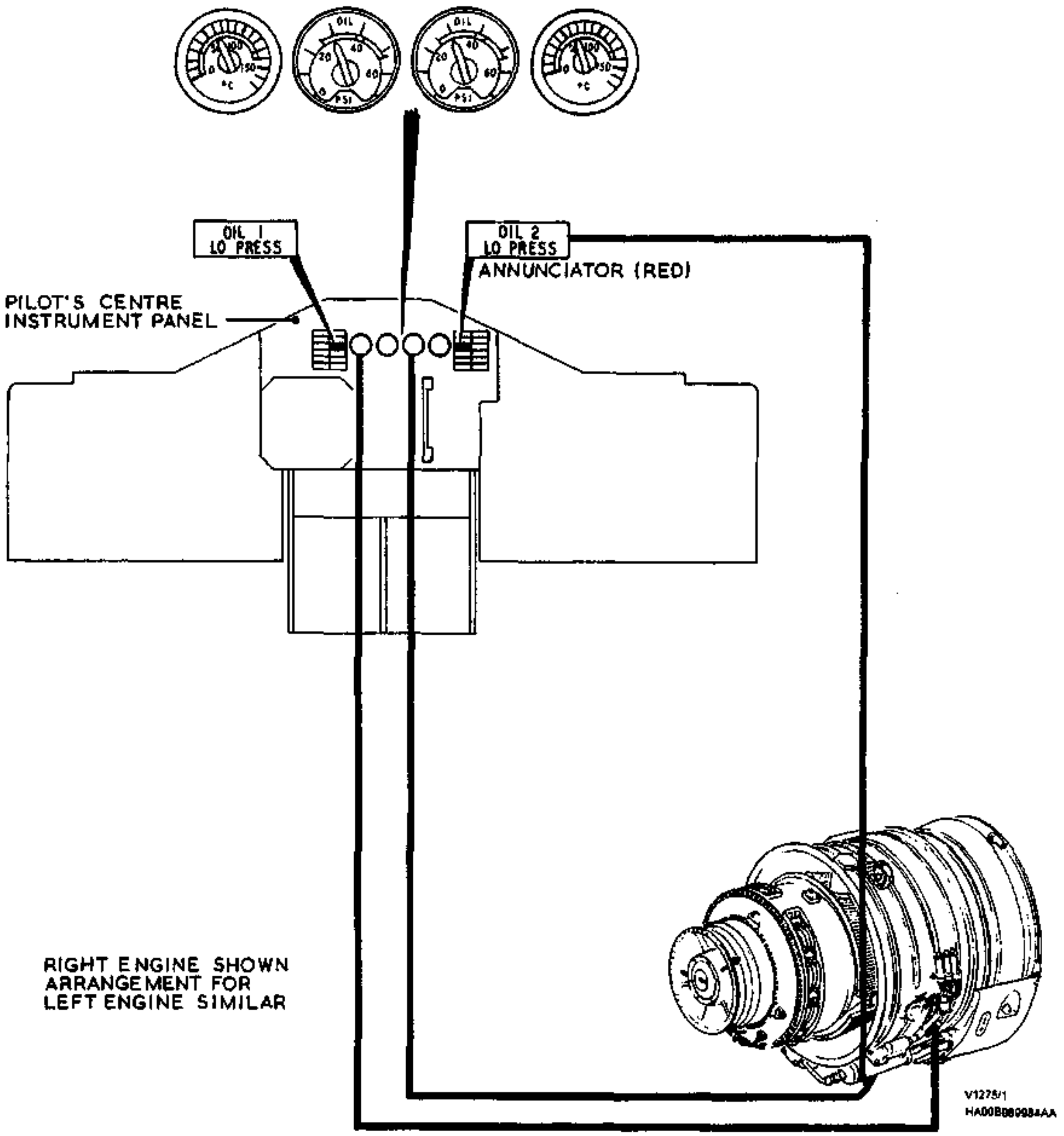
## 3. Oil temperature indication

This indicator, installed with integral lighting, is connected to a temperature bulb installed in the engine oil supply manifold. The indicator has a single pointer moving over a dial face marked in increments of 10° C from 0 to 170° C. The scale is divided into color zones:

0° to 30° C - Amber
30° to 127° C - Green
127° C to 140° C- Amber
140° C radial line - Red.

## 4. Oil low pressure annunciator

A pressure switch tapped into the supply line from the oil pump is normally held open by engine oil pressure. When the oil pressure decreases to less than 23 psi, the switch closes to light an associated OIL 1 or 2 LO PRESS red MWS annunciator. The light goes out when pressure increases to above 25 psi.



Power plant - oil indicating
*Figure 1*

# OIL TEMPERATURE BULB REMOVAL/INSTALLATION

## 1. Oil Temperature Bulb

### A. Removal

(1) Open appropriate circuit breaker, Table 401 (Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(2) Unlatch and stay open the engine lower access door.

(3) Drain the engine oil system as described in the *Allied Signal*, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, SERVICING.

(4) Disconnect the electrical harness connector from the oil temperature bulb.

(5) Unscrew and remove the temperature bulb from the engine oil supply manifold. Discard O-ring.

(6) Seal off the bulb boss on the supply manifold.

### B. Installation

(1) Make sure that the oil temperature bulb is clean and undamaged.

(2) Install new O-ring to the bulb.

(3) Remove cap from manifold and screw in temperature bulb.

(4) Connect the engine electrical harness connector to the temperature bulb.

(5) Close appropriate circuit breaker.

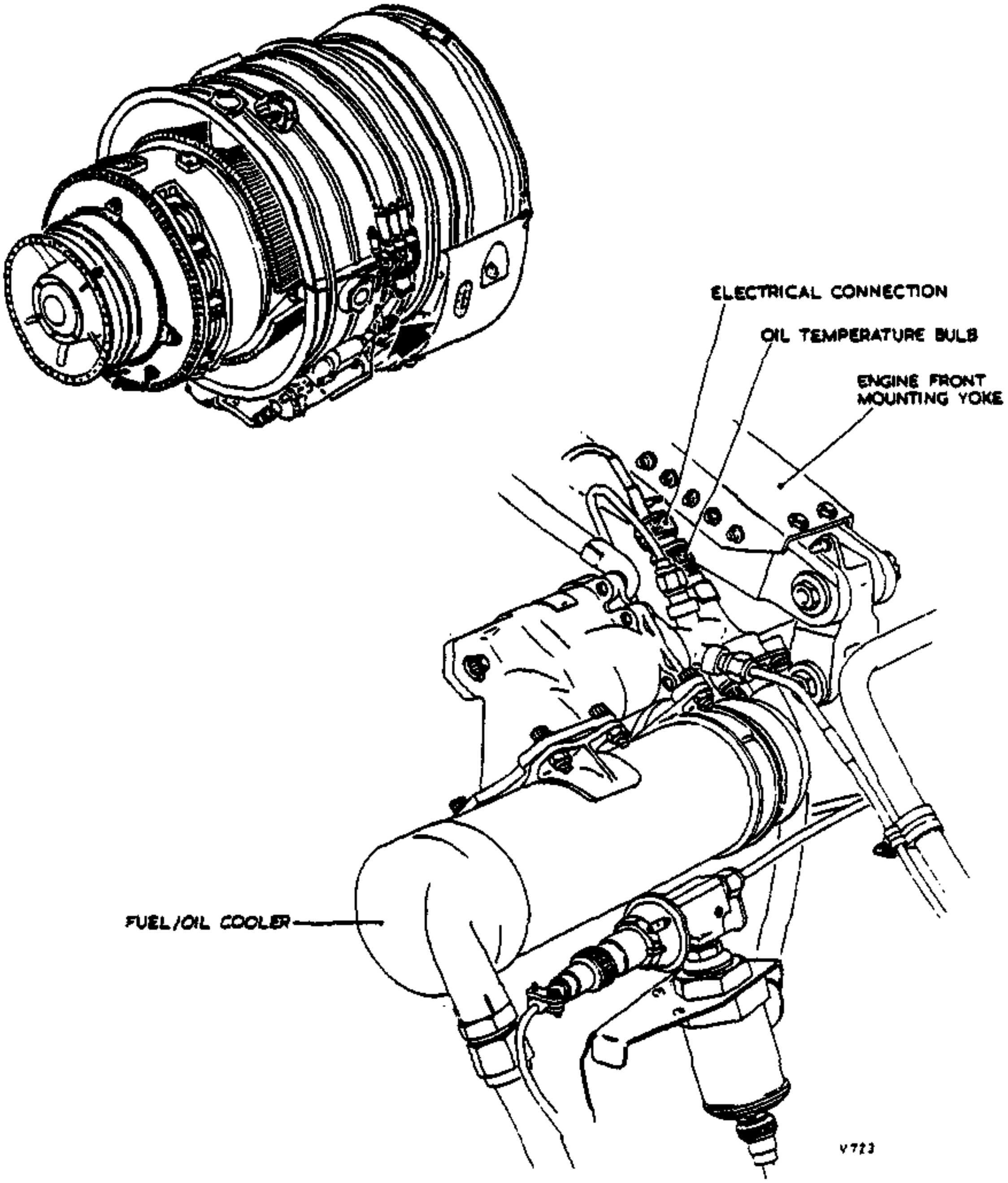
(6) Fill engine oil system as for initial installation of engine in the Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, SERVICING..

(7) Examine the installation for leaks and that the oil temperature indicator on the pilots' center instrument panel registers normal for the engine condition.

(8) Close the lower access door.

*Table 401*
OIL TEMPERATURE BULB
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | C/B Ident | Grid Ref |
|---|---|---|---|---|---|
| Oil temperature bulb | Left | PE | E | Oil Temp LH | B9 |
|  | Right | PE | E | Oil Temp RH | B10 |



Engine oil temperature bulb
*Figure 401*

EFFECTIVITY: F400A

# OIL PRESSURE TRANSMITTER REMOVAL/INSTALLATION

## 1. Oil Pressure Transmitter *(Figure 401)*

### A. Removal

(1) Remove appropriate circuit breaker, Table 401 (Chapter 24, ELECTRICAL POWER - GENERAL for precautions).

(2) Unlatch the power plant lower access door and stay in the open position (Chapter 71, POWER PLANT - COWLINGS).

(3) Drain the engine oil system as described in the Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, SERVICING.

(4) Disconnect the electrical harness from the transmitter.

(5) Release the locking wire and loosen the locknut, locking the transmitter to the special tee-piece.

(6) Loosen the nut securing the transmitter to its mounting bracket until it is completely free of the transmitter threads.

(7) Unscrew the transmitter from the special tee-piece and remove from the mounting bracket complete with attachment nut.

(8) Discard O-ring from transmitter boss.

(9) Seal off tee-piece aperture.

### B. Installation

(1) Make sure that the transmitter is undamaged and clean.

(2) Remove tee-piece cap.

(3) Install new O-ring into transmitter boss.

(4) Enter transmitter up through its mounting bracket and just locate the attachment nut on its threads.

(5) Screw the transmitter onto the special tee-piece and tighten on the O-ring.

(6) Tighten down the tee-piece locknut on to the transmitter.

(7) Tighten down the attachment nut to secure the transmitter on the mounting bracket.

(8) Wire-lock the nuts.

(9) Connect the engine electrical harness to the transmitter.

(10) Close appropriate circuit breaker.

(11) Fill the engine oil system as for initial engine installation in the Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, SERVICING.

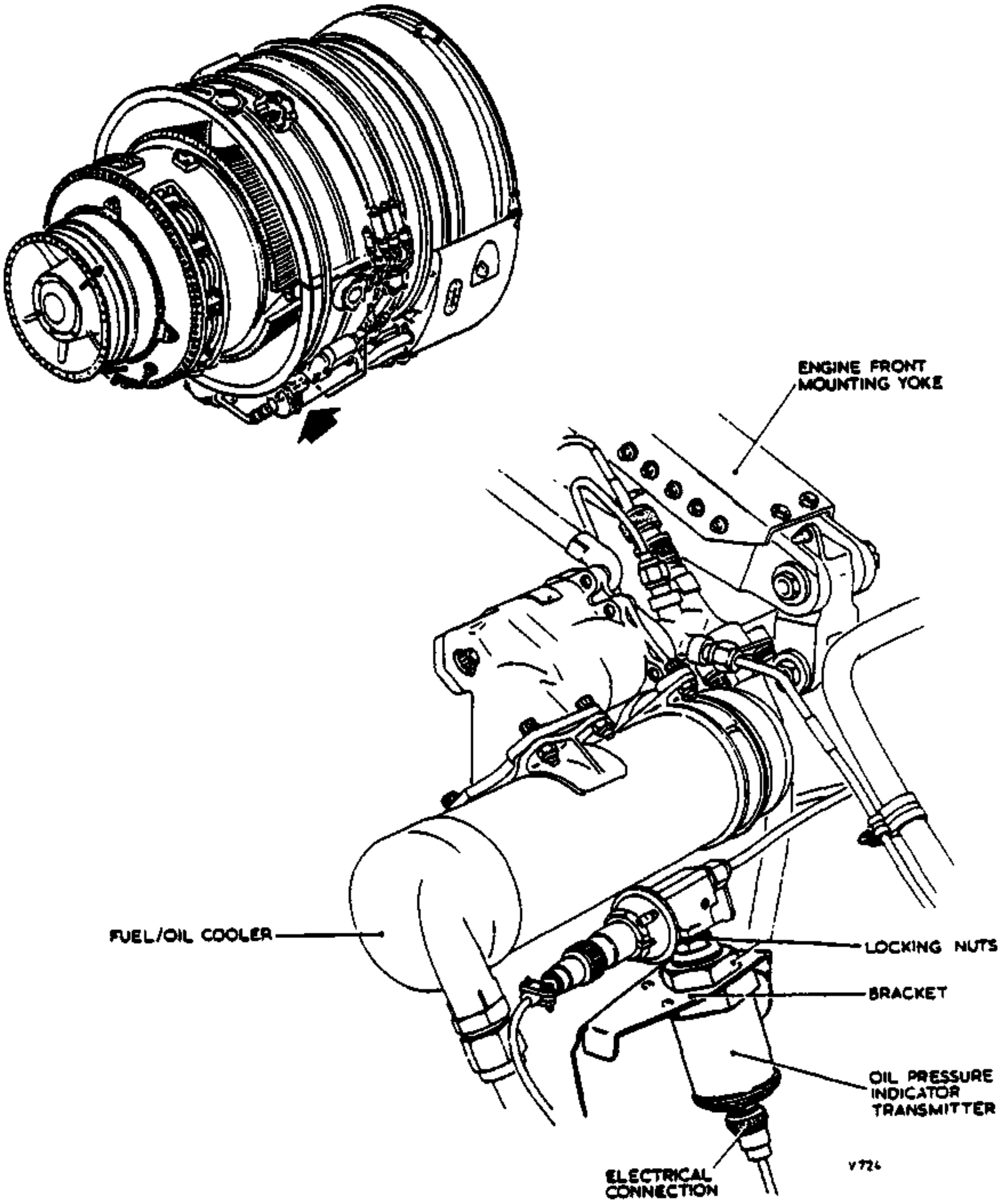
(12) Make sure the oil pressure indicator registers oil pressure normal to the engine condition (Allied Signal, Light Maintenance Manuals - Report No. 72-02-15, Chapter 72-00-00, ADJUSTMENT/ TEST).

(13) Examine the transmitter connection for leaks.

(14) Stop the engine and close the lower access door.

Table 401
OIL PRESSURE TRANSMITTER
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | C/B Ident | Grid Ref |
|---|---|---|---|---|---|
| Oil pressure transmitter | Left<br>Right | PE<br>PE | D<br>D | Oil Press LH<br>Oil Press RH | B2<br>B3 |


ENGINE FRONT MOUNTING YOKE
FUEL/OIL COOLER
LOCKING NUTS
BRACKET
OIL PRESSURE INDICATOR TRANSMITTER
ELECTRICAL CONNECTION
V726

Oil pressure transmitter
*Figure 401*

# OIL PRESSURE SWITCH REMOVAL/INSTALLATION

## 1. Oil Pressure Switch *(Figure 401)*

### A. Removal

(1) Remove appropriate fuse, Table 401. Refer to Chapter 24, ELECTRICAL POWER - GENERAL for precautions.

(2) Unlatch and stay open the power plant lower access door (Chapter 71, POWER PLANT).

(3) Drain the engine oil system as described in the Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, SERVICING.

(4) Disconnect the electrical harness from the pressure switch.

(5) Loosen the pressure switch locknut off the special tee-piece.

(6) Unscrew and remove the pressure switch from the tee-piece and discard the O-ring.

(7) Seal off the tee-piece.

### B. Installation

(1) Make sure that the pressure switch is clean and undamaged.

(2) Install new O-ring to the pressure switch.

(3) Remove cap from the tee-piece and screw in the pressure switch.

(4) Tighten down locknut on the tee-piece and wire-lock.

(5) Connect the engine electrical harness to the pressure switch.

(6) Install appropriate fuse.

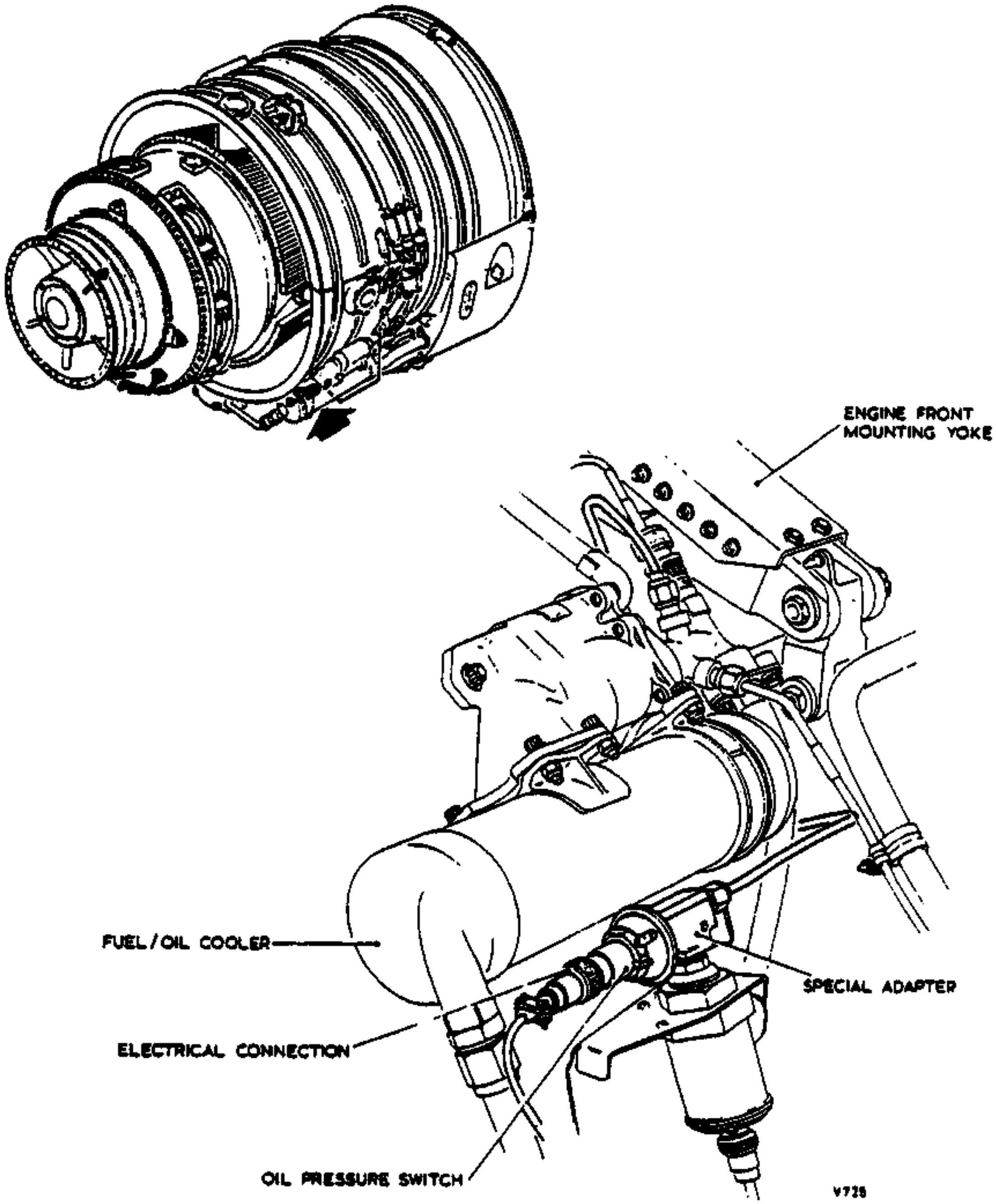
(7) Fill the engine oil system as for initial installation of engine in the Allied Signal, Light Maintenance Manual - Report No. 72-02-15, Chapter 72-00-00, SERVICING..

(8) Examine installation for oil leaks and that the OIL LOW PRESS red annunciator on the pilots' center main instrument panel, goes out above 25 psi.

(9) Stop the engine and close the lower access door.

Table 401
OIL PRESSURE SWITCH
POWER SUPPLY DETAILS

| Equipment | Engine | Supply | Panel | Fuse |
|---|---|---|---|---|
| Oil low pressure warning switch | Left<br>Right | PE<br>PE | ZL<br>ZL | F21<br>F22 |



Engine oil pressure switch
*Figure 401*

# CHAPTER

# 80

# STARTING

# CHAPTER 80

# STARTING

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# STARTING
# GENERAL
# (Pre-Mod. 256989 and 256990)

## 1. Description

The engine starting system comprises a starter/generator to propel each engine to self-sustaining speed and to ignite an air/fuel mixture, in the combustor chamber, by simultaneous operation of high energy ignition and fuel priming components during the starting cycle. Facilities for relighting a windmilling engine in flight, with or without starter assistance, are also provided.

Electrical power to operate the system is obtained from either the aircraft batteries (internal start) or from an external ground power unit (external start). The internal starting facilities include a starting circuit feature whereby the aircraft batteries are arranged in parallel, through an internal start contactor, to provide a nominal 24 volt supply at the start busbar.

An engine cross-starting inhibit facility is included to prevent cross starting from the "on-line" generator of the first engine to be started when making an internal start.

Whenever possible, an external power source should be used and this should be capable of producing and sustaining 28 volts d.c. at loads up to 1,000 amperes and must also incorporate a current limiting device to operate at 1,100 amperes. The external power unit is plugged into a three-pin plug (N.A.T.O. standard) on the rear fuselage right side.

Internal (BATTERY) and external (EXT POWER) supply switches are located on the roof switch panel CG. The ENGINE START section, on roof panel CG, comprises the following indicator lamps and switches:-

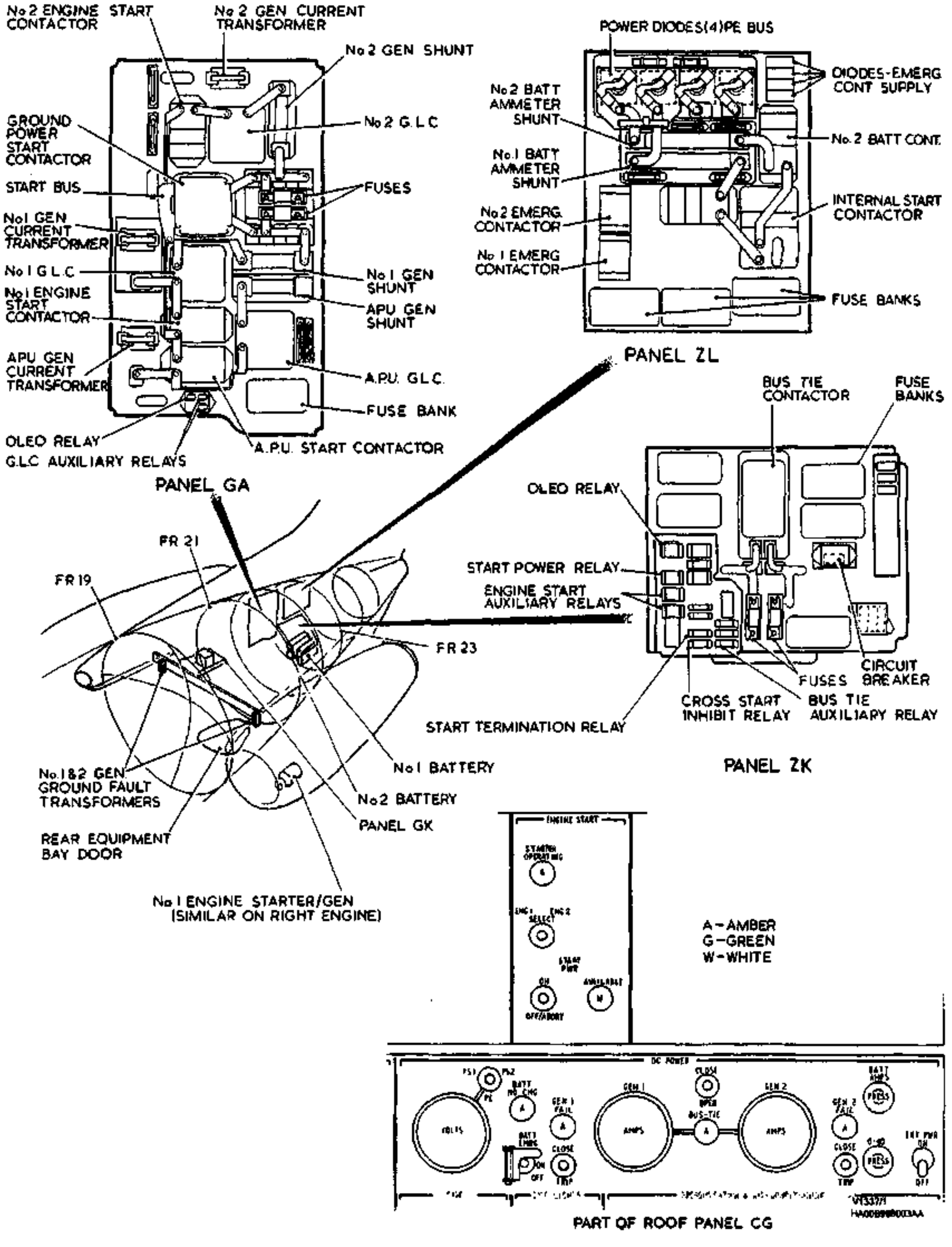
(1) START PWR ON - OFF/ABORT switch and AVAILABLE lamp.

(2) ENG 1 - ENG 2 SELECT switch.

(3) STARTER OPERATING lamp.

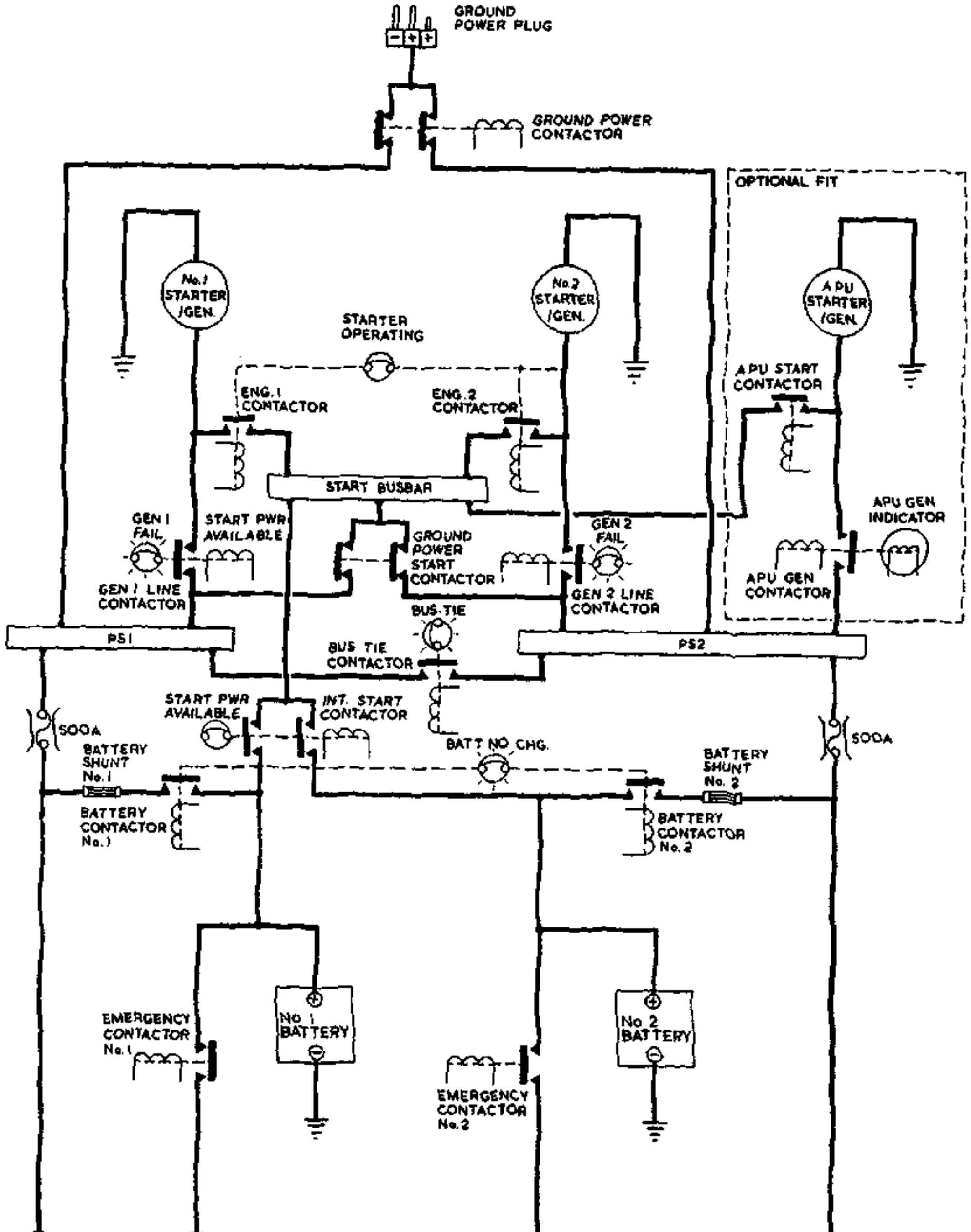
*NOTE: Reference to a "start busbar" refers to a connecting point common to all the start contactors and ground power contactor.*

Two igniter units, one associated with each engine, are activated during the engine start cycle by a microswitch on the associated HP cock lever which is opened manually when the engine speed reaches 10% of the nominal range.



Starting - Location of components

*Figure 1*



Ground power connected

*Figure 2*

## 2. Operation

*NOTE: Where references are made in the text to generator (main or APU), busbar and battery control circuits, reference should be made to the relevant sections in Chapter 24, ELECTRICAL POWER. This is done to avoid overcomplicating the engine starting schematic Figure 4 and to curtail duplicated descriptions. Furthermore, as both engine starting circuits are similar in operation, only No.2 is described.*

### A. External start

With an external 28 volt d.c. supply connected and the EXT POWER switch selected ON, the ground power contactor (G.P.C.), ground power start contactor (G.P.S.C.) and the APU ground power auxiliary relay operating coils are energized. Closure of the G.P.C. and G.P.S.C. main contacts connects the external supplies to busbars PS1, PS2 and PE and provides a standing positive supply at the main contacts of the engine start contactors. The auxiliary contacts changeover to:

(1) Make sure that Gen.1 and Gen.2 output feeder lines are isolated from the ground supply by interrupting the generator line input to the generator control unit (GCU) sensing circuit (pin J) and thus inhibiting the generator line contactors (GLC) (Chapter 24, ELECTRICAL POWER - DC GENERATION).

(2) Isolate the 'internal start' and emergency contactor coil supplies when the battery select switch is selected to ON.

The APU ground power auxiliary relay contacts change over to interrupt the APU GCU operating coil supply thereby preventing the APU generator supplying the busbars.

With the battery select switch set to ON and the START PWR switch selected ON, a supply from No.1 battery illuminates the START PWR AVAILABLE lamp through operated contacts of the ground power contactor.

Subsequent momentary operation of ENG 2 SELECT switch routes a supply from busbar PE as follows:

(1) Via No.1 start auxiliary relay to the No.2 generator control unit pin W, through the internal speed switch to pin Z to operate the start termination relay.

(2) Operates the start power relay via the start termination relay contacts and thus energize No.2 start contactor and No.2 start auxiliary relay.

(3) Provides the supply to illuminate the STARTER OPERATING lamp and the starter/generator to initiate engine rotation.

No.2 engine start auxiliary relay effects power routing changes as follows:

(1) Routes a supply to activate No.2 engine igniter after the HP fuel cock has been actuated manually (at an engine speed of 10% N2).

(2) Lights the IGNITION ON lamp on the roof switch panel.

(3) Provides a lock-on supply to No.2 main start contactor and No.2 start auxiliary relay via No.1 engine start switch and the start power relay.

Closure of the engine start contactor directs the heavy duty supply through the main contacts to the starter/generator to initiate engine rotation. The auxiliary contacts of this contactor illuminate the engine operating annunciator, as stated previously, allowing the start switch to be released.

### B. Internal start

With the BATTERY selector switch set to ON, power is routed via the normally closed contacts of the ground power contactors and BATT AMPS switch to energize both emergency contactors. The contactors when closed connect No.1 and No.2 batteries in parallel to the emergency busbar PE (Chapter 24, ELECTRICAL POWER - DC GENERATION).

Operating the START PWR switch closes the internal start contactor to:

(1) Connect No.1 and No.2 batteries in parallel to the 'start busbar' through the main contacts.

(2) Isolate the ground power supply (Chapter 24, ELECTRICAL POWER - DC GENERATION).

(3) Isolate the APU generator line contactor (if installed and when generator No.2 auxiliary relay energized).(Chapter 24, ELECTRICAL POWER - APU GENERATION).

(4) Illuminate the START POWER AVAILABLE lamp from No.1 battery.

The engine start circuit is now in an armed condition, awaiting selection of an engine start switch, which would result in a sequence of events previously described in paragraph A, except that parallel connected internal batteries provide the initial power instead of a ground supply. When starting the second engine in this configuration, the cross start inhibit relay becomes effective. This relay is energized when the start termination relay operates and inhibits the battery contactors thus preventing an on-line generator output being connected to the start busbar.

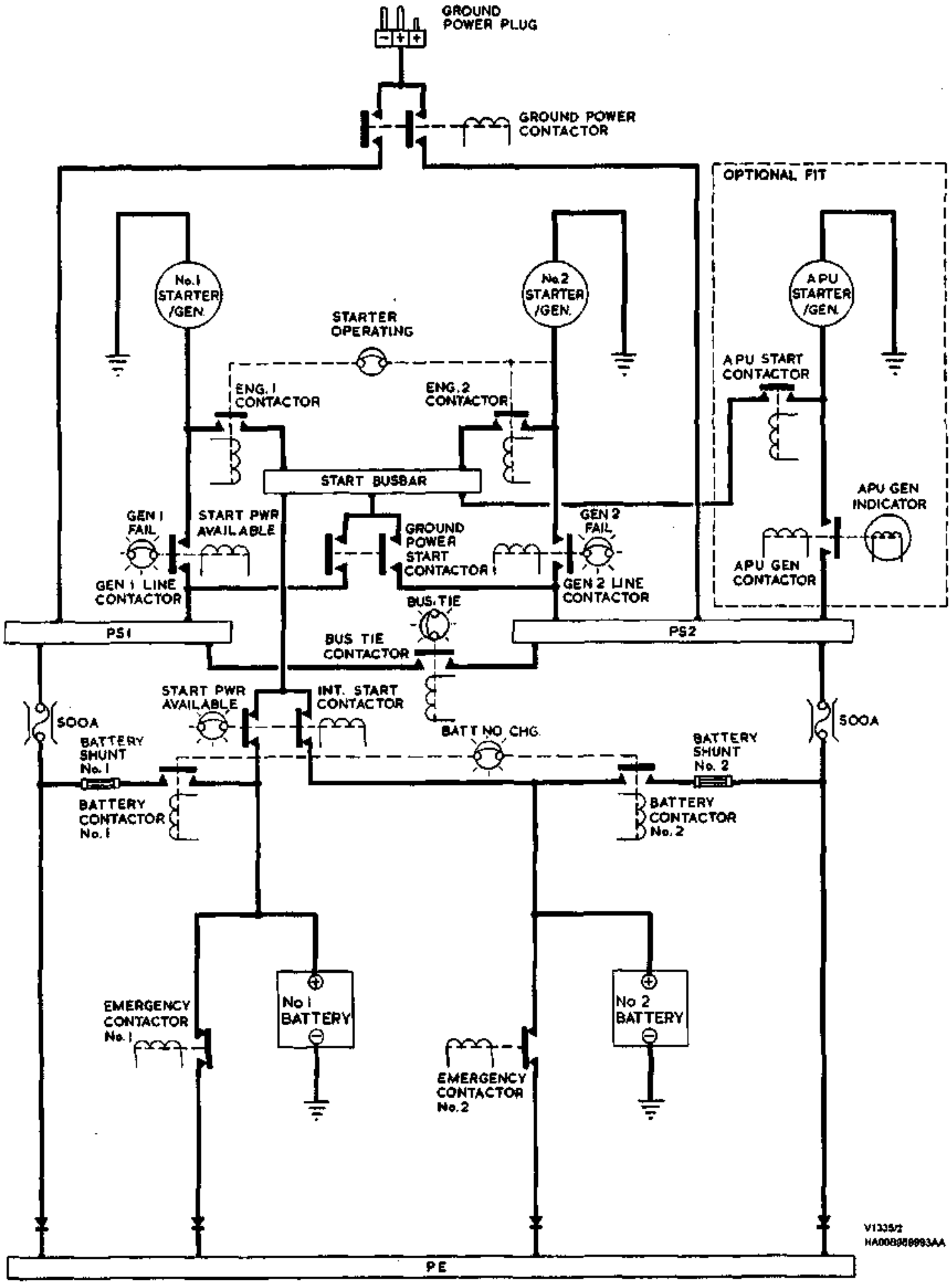
### C. Engine start termination (external or internal supply)

Starter cut-off is normally controlled automatically by a speed signal obtained from a magnetic pick-up on the starter/generator which is fed into the generator control unit where, at a starter speed of approximately 5,500 r.p.m., it terminates the d.c. supply between pins W-Z. Loss of this supply, de-energizes the start termination relay, the now open contacts of which de-energizes the START/PWR relay, followed by the ENG START contactor and ENG START auxiliary relay which in turn isolates the supply to the igniter unit, the IGNITION ON and STARTER OPERATING lamps.

After successful completion of internal start of both engines or when it is desirable for only one engine to be operating, the START PWR AVAILABLE lamp will still be illuminated indicating that power to energize the internal start contactor is still being applied. To revert the system to an 'operational mode' from the 'starting mode' the START PWR switch must be selected OFF to relax the internal start relay and cancel the indicating light.

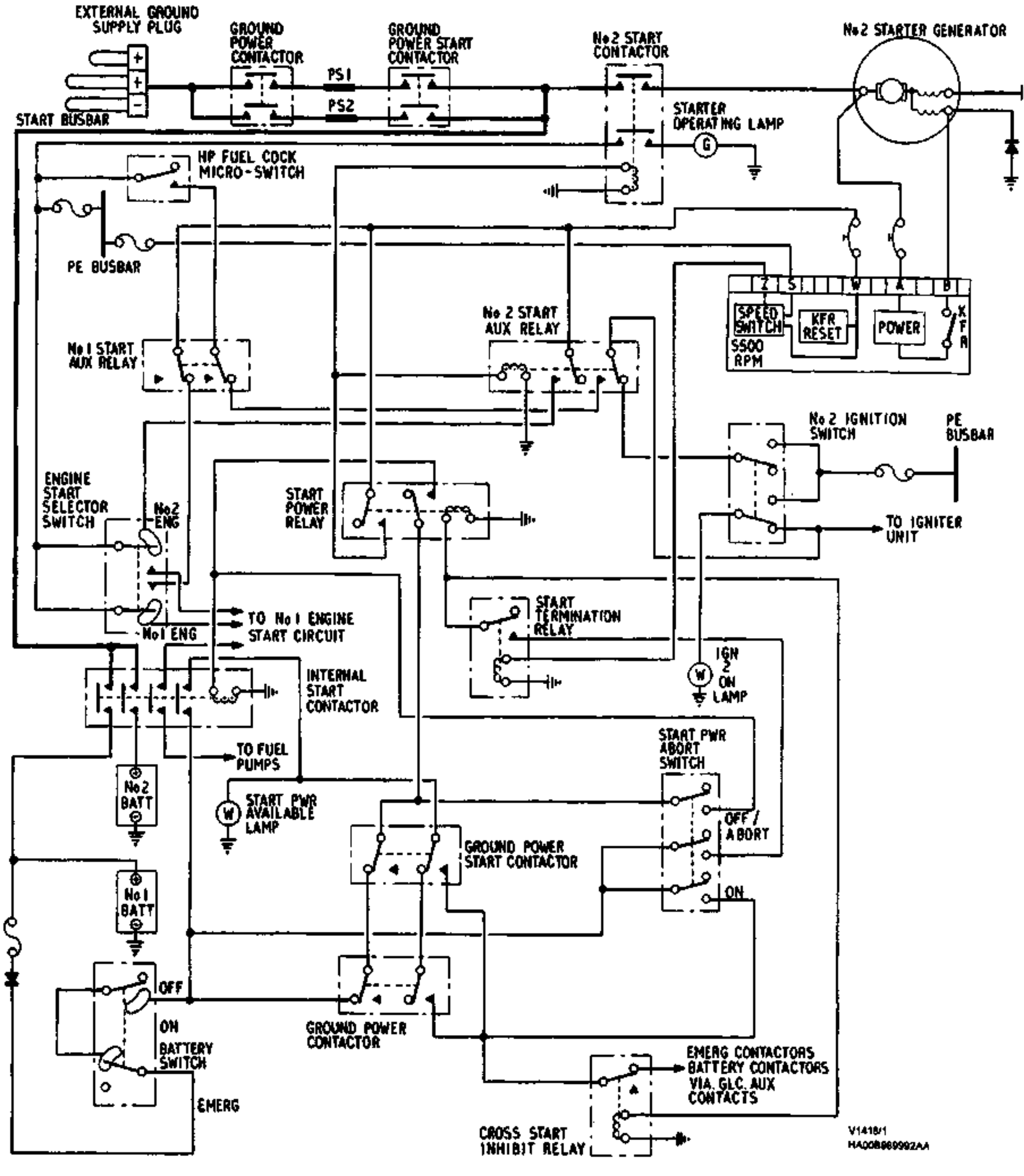
At this stage, the battery voltage is still applied to busbar PE via the emergency contactors and this provides the reference voltage for comparison with the generator output. The generator control unit monitors the voltage differential and at a balanced voltage of 0.3V or less the unit delivers a voltage output at pin H to energize the generator line contactor. Closure of this contactor initiates the following:

(1) Completes a circuit to enable the busbars PS1 and PS2 to be paralleled if required.



Internal start

*Figure 3*



Starting - theoretical

*Figure 4*

(2) Energizes the corresponding battery contactor (battery switch at NORMAL or EMERG) to provide busbar backing and enable the batteries to be charged.

(3) Breaks the supply to the relevant GEN FAIL lamp and the C.A.G.S.

A similar sequence of events exists when the external supply is used except that the internal start and emergency contactors remain relaxed and the supply is isolated by switching OFF the EXT PWR switch when the generators are on line.

### D. In flight engine relighting

An ENG. IGNITION switch and IGN. ON annunciator for each main engine system is provided on roof panel CG. The switch when selected ON, connects a supply from busbar PE to light the IGN. ON annunciator and also provide an operating supply to the igniter unit via No.2 start auxiliary relay.

# STARTING
# TROUBLE SHOOTING

## 1. General

**CAUTION: BEFORE ATTEMPTING ENGINE STARTS, OBSERVE ALL NECESSARY SAFETY PRECAUTIONS (CHAPTER 71, POWER PLANT - GENERAL).**

### A. The trouble shooting charts have been compiled on the assumption that:

(1) The reported faulty system will be checked by the operator to make sure that the fault is not due to incorrect switching procedures.

(2) All relevant circuit breakers are closed, and that the circuit fuses and filaments are serviceable.

(3) External ground supplies, where used, are completely serviceable.

(4) All aircraft batteries are correctly connected and in a satisfactory state of charge.

(5) Where the term 'check' is used in connection with switches, relays, contactors etc., it implies that the operator will check the input and output voltages at the 'in use' terminals in the inoperated and operated state.

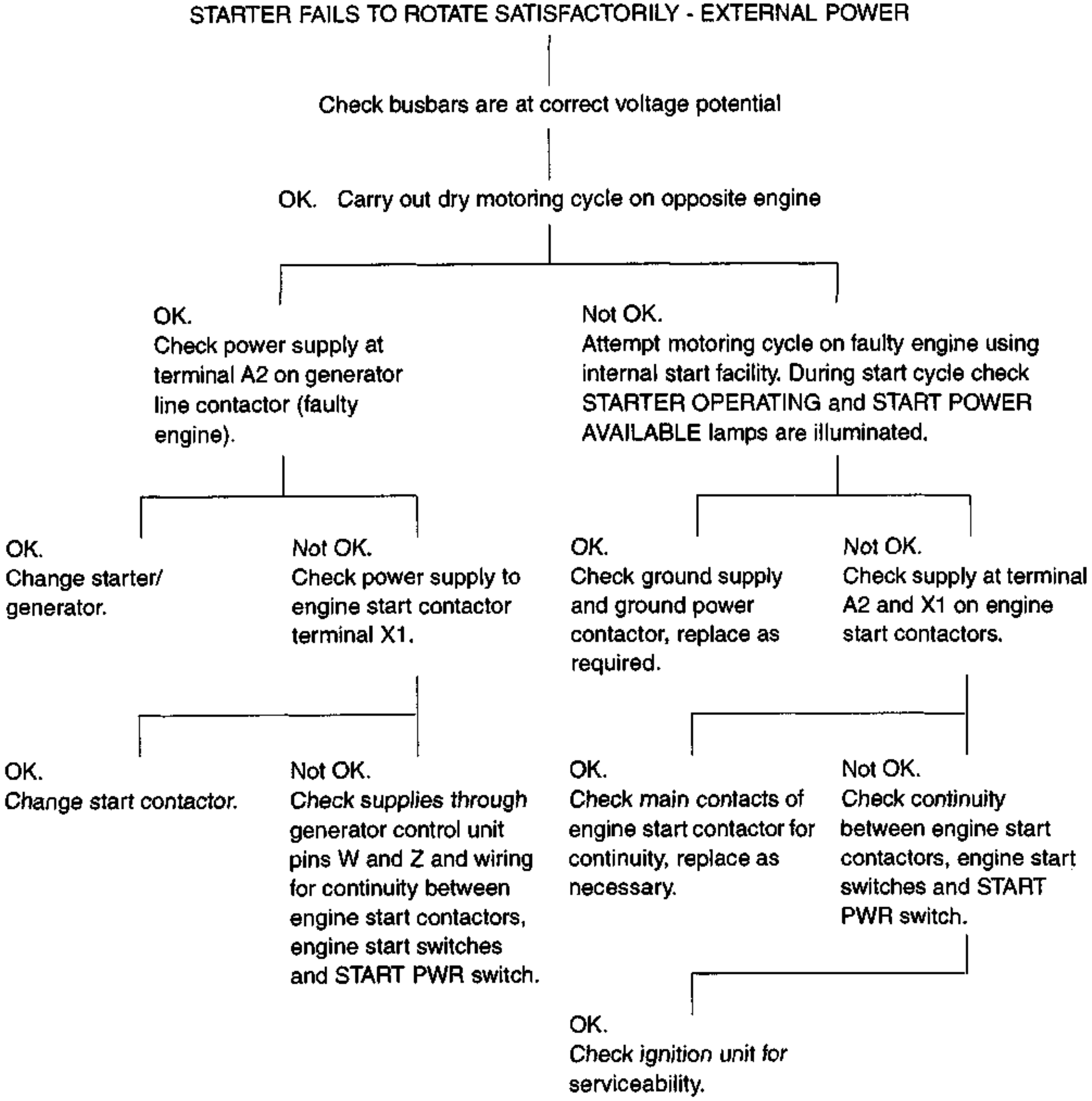
(6) The electrical connections to suspect units will be verified before removal of such units.

(7) All relevant earth connections will be verified at the various stages of fault location.

(8) Continuity checks will be done as required.

(9) Trouble shooting is not attempted without reference to the relevant routing charts.

(10) When a fault has been discovered and rectified, the system must be given a functional test as laid down in the appropriate system Maintenance Practices.



STARTER FAILS TO ROTATE SATISFACTORILY - EXTERNAL POWER

Check busbars are at correct voltage potential

OK. Carry out dry motoring cycle on opposite engine

OK.
Check power supply at terminal A2 on generator line contactor (faulty engine).

OK.
Change starter/ generator.

Not OK.
Check power supply to engine start contactor terminal X1.

OK.
*Change start contactor.*

Not OK.
*Check supplies through* generator control unit pins W and Z and wiring for continuity between engine start contactors, engine start switches and START PWR switch.

Not OK.
Attempt motoring cycle on faulty engine using internal start facility. During start cycle check STARTER OPERATING and START POWER AVAILABLE lamps are illuminated.

OK.
Check ground supply and ground power contactor, replace as required.

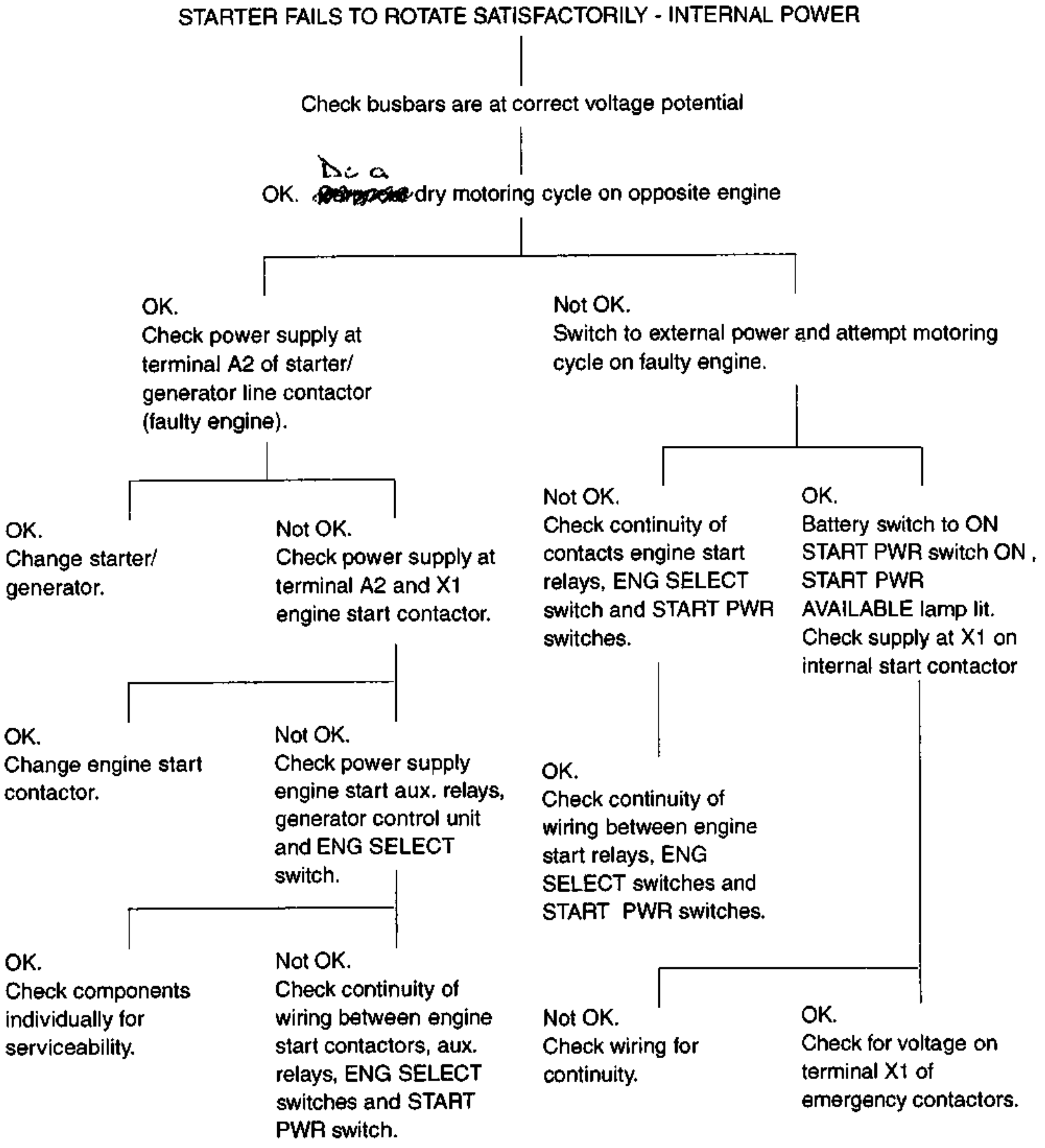
Not OK.
Check supply at terminal A2 and X1 on engine start contactors.

OK.
*Check main contacts of* engine start contactor for continuity, replace as necessary.

Not OK.
Check continuity between engine start contactors, engine start switches and START PWR switch.

OK.
*Check ignition unit for* serviceability.

External power
*Chart 101*



STARTER FAILS TO ROTATE SATISFACTORILY - INTERNAL POWER

Check busbars are at correct voltage potential

OK. Do a ~~[illegible]~~ dry motoring cycle on opposite engine

OK.
Check power supply at terminal A2 of starter/generator line contactor (faulty engine).

OK.
Change starter/generator.

Not OK.
Check power supply at terminal A2 and X1 engine start contactor.

OK.
Change engine start contactor.

Not OK.
Check power supply engine start aux. relays, generator control unit and ENG SELECT switch.

OK.
Check components individually for serviceability.

Not OK.
Check continuity of wiring between engine start contactors, aux. relays, ENG SELECT switches and START PWR switch.

Not OK.
Switch to external power and attempt motoring cycle on faulty engine.

Not OK.
Check continuity of contacts engine start relays, ENG SELECT switch and START PWR switches.

OK.
Check continuity of wiring between engine start relays, ENG SELECT switches and START PWR switches.

OK.
Battery switch to ON
START PWR switch ON ,
START PWR AVAILABLE lamp lit.
Check supply at X1 on internal start contactor

Not OK.
Check wiring for continuity.

OK.
Check for voltage on terminal X1 of emergency contactors.

Internal power
*Chart 102*

# STARTING
# ADJUSTMENT/TEST

## 1. Functionally test starting system

### A. Procedure

(1) Start the engine, refer to Chapter 71-00-00, ADJUSTMENT/TEST.

# STARTING
# GENERAL
# (Mod. 256989 and 256990)

## 1. Description

The engine starting system comprises a starter/generator to propel each engine to self-sustaining speed and to ignite an air/fuel mixture, in the combustor chamber, by simultaneous operation of high energy ignition and fuel priming components during the starting cycle. Facilities for relighting a windmilling engine in flight, with or without starter assistance, are also provided.

Electrical power to operate the system is obtained from either the aircraft batteries (internal start) or from an external ground power unit (external start). The internal starting facilities include a 'normal' starting circuit feature whereby the aircraft batteries are arranged in parallel through the series battery contactor (de-energized) to provide a nominal 24 volt supply at the start busbar, and a cold starting facility which provides for series connection of the batteries through the series battery contactor (energized) to provide a nominal 48 volt supply at the start busbar. To supplement the starting requirements during cold starting, a third battery output (24 volts 4AH) is connected to busbar PE extension.

Circuit interlocks, employing various contactors and auxiliary relays, makes sure that isolation of the 48 volts supply from the generator control unit (GCU) and the aircraft services busbars. An engine cross-starting inhibit facility is included to prevent cross starting from the 'on-line' generator of the first engine to be started when making an internal start.

Whenever possible, an external power source should be used. This should be capable of producing and sustaining 28 volts d.c. at loads up to 1,000 amperes and must also incorporate a current limiting device to operate at 1,100 amperes. The external power unit is plugged into a three-pin plug (N.A.T.O. standard) on the rear fuselage right side.

Internal (BATTERY) and external (EXT POWER) supply switches are located on the roof switch panel CG. The relevant ENGINE START switches and indicators are also on the roof switch panel CG and are designated:-

(1) START PWR ON - OFF/ABORT switch and AVAILABLE lamp.

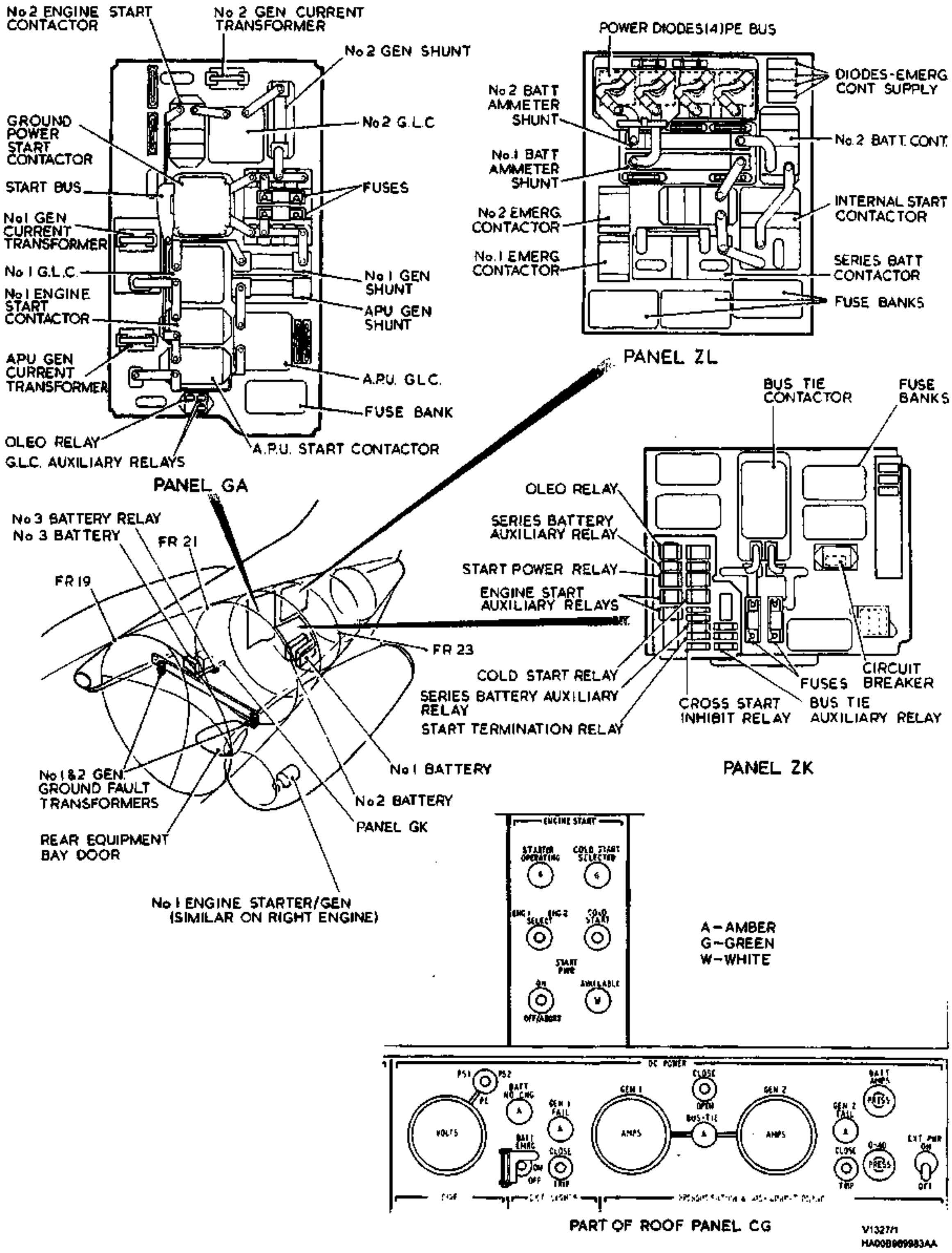
(2) ENG.1- ENG.2 SELECT switch.

(3) COLD START switch and COLD START SELECTED lamp.

(4) STARTER OPERATING lamp.

*NOTE: Reference to a "start busbar" refers to a connecting point common to all the start contactors and ground power contactor.*

Two igniter units, one associated with each engine, are activated, during the engine start cycle, by a microswitch on the associated HP cock lever which is opened, manually, when the engine speed reaches 10% of the nominal range.



Starting - Location of components

*Figure 1*

## 2. Operation

*NOTE: Where references are made in the text to generator (main or APU), busbar and battery control circuits, reference should be made to the relevant sections in Chapter 24, ELECTRICAL POWER. This is done to avoid overcomplicating the engine starting schematic Figure 4 and to curtail duplicated descriptions. Furthermore, as both engine starting circuits are similar in operation, only No.2 is described.*

### A. External start

With an external 28 volt d.c. supply connected and the EXT POWER switch selected ON, The ground power contactor (G.P.C.), ground power start contactor (G.P.S.C.) and the APU ground power auxiliary relay operating coils are energized. Closure of the G.P.C. and G.P.S.C. main contacts connects the external supplies to busbars PS1, PS2 and PE and provide a standing positive supply at the main contacts of the engine start contactors. The auxiliary contacts changeover to:

(1) Make sure that Gen.1 and Gen.2 output feeder lines are isolated from the ground supply by interrupting the generator line input to the generator control unit (GCU) sensing circuit (pin J) and thus inhibiting the generator line contactors (GLC) (Chapter 24, ELECTRICAL POWER - DC GENERATION).

(2) Isolate the 'internal start' and emergency contactor coil supplies when the battery select switch is selected to ON.

With an APU generating system installed, the APU ground power auxiliary relay contacts change over to interrupt the APU GCU operating coil supply thereby preventing the APU generator supplying the busbars.

With the battery select switch set to ON and the START PWR switch selected ON, a supply from No.1 battery illuminates the START PWR AVAILABLE lamp through operated contacts of the ground power contactors.

Subsequent momentary operation of ENG 2 start switch routes a supply from busbar PE as follows:

(1) Via No.1 start auxiliary relay to the No.2 generator control unit pin W, through the internal speed switch to pin Z to operate the start termination relay.

(2) Operates the start power relay via the start termination relay contacts and thus energize No.2 start contactor and No.2 start auxiliary relay.

(3) Provides the supply to illuminate the 'No.2 engine operating' annunciator via the start contactor's auxiliary contacts.

No.2 engine start auxiliary relay effects power routing changes as follows:

(1) Routes a supply to activate No.2 engine igniter after the HP fuel cock has been actuated manually (at an engine speed of 10% N2).

(2) Lights the IGNITION ON lamp on the roof switch panel.

(3) Provides a lock-on supply to No.2 main start contactor and No.2 start auxiliary relay via No.1 engine start switch and the start power relay.

Closure of the engine start contactor directs the heavy duty supply through the main contacts to the starter/generator to initiate engine rotation. The auxiliary contacts of this contactor illuminate the engine operating annunciator, as stated previously, allowing the start switch to be released.

### B. Internal start

With the BATTERY selector switch set to ON, power is routed via the normally closed contacts of the ground power contactors, the cold start relay, series battery contactor and BATT AMPS switch to energize both emergency contactors. The contactors when closed connect No.1 and No.2 batteries in parallel to the emergency busbar PE (Chapter 24, ELECTRICAL POWER - DC GENERATION).

Operating the START PWR switch to ON closes the internal start contactor to:

(1) Connect No.1 and No.2 batteries in parallel to the 'start busbar' through the main contacts.

(2) Isolate the ground power supply (Chapter 24, ELECTRICAL POWER - DC GENERATION).

(3) Isolate the APU generator line contactor (if installed and when generator No.2 auxiliary relay energized). (Chapter 24, ELECTRICAL POWER - APU GENERATION).

(4) Illuminate the START POWER AVAILABLE lamp from No.1 battery.

The engine start circuit is now in an armed condition, awaiting selection of an engine start switch, which would result in a sequence of events previously described in paragraph A, except that parallel connected internal batteries provide the initial power instead of a ground supply. When starting the second engine in this configuration, the cross start inhibit relay becomes effective. This relay is energized when the start termination relay operates and inhibits the battery contactors thus preventing an on-line generator output being connected to the start busbar.

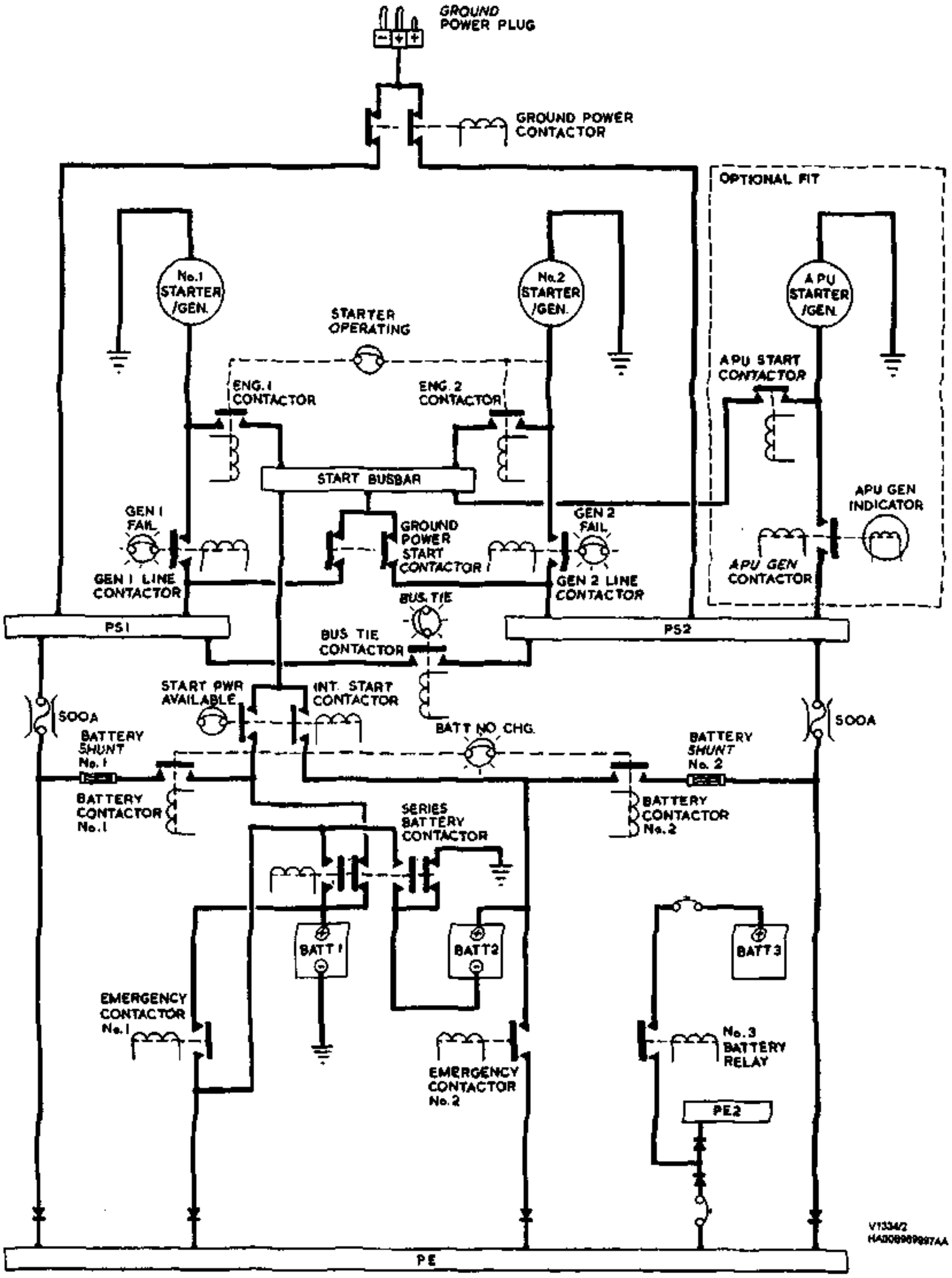
### C. Engine start termination (external or internal supply)

Starter cut-off is normally controlled automatically by a speed signal obtained from a magnetic pick-up on the starter/generator which is fed into the generator control unit where, at a starter speed of approximately 5,500 r.p.m., it terminates the d.c. supply between pins W-Z. Loss of this supply, de-energizes the start termination relay, the now open contacts of which de-energizes the START/PWR relay, followed by the ENG START contactor and ENG START auxiliary relay which in turn isolates the supply to the igniter unit, the IGNITION ON and STARTER OPERATING lamps.

After successful completion of internal start of both engines or when it is desirable for only one engine to be operating, the START PWR AVAILABLE lamp will still be illuminated indicating that power to energize the internal start contactor, is still being applied. To revert the system to an 'operational mode' from the 'starting mode' the START PWR switch must be slected OFF to relax the internal start relay and cancel the indicating light.

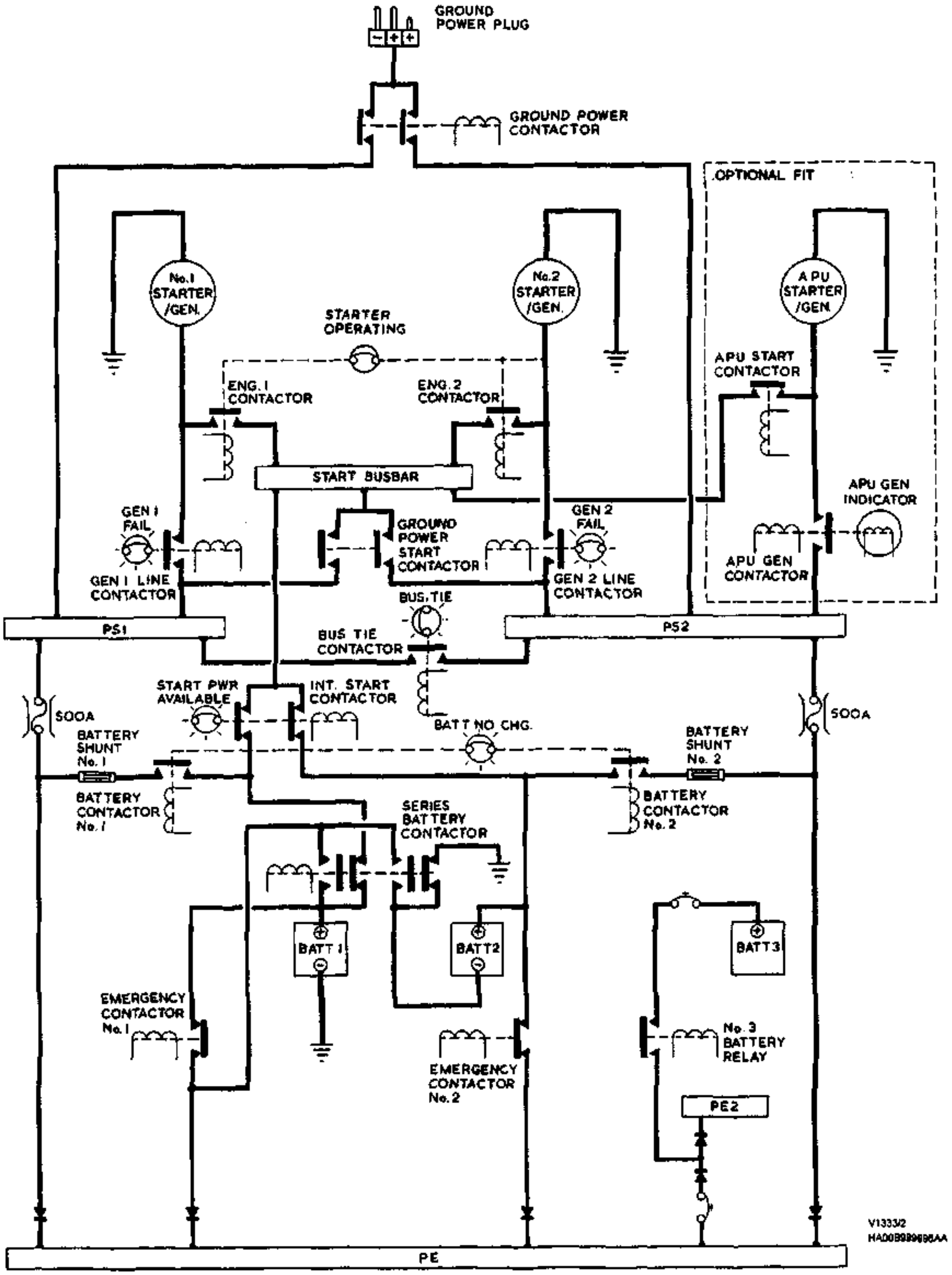
At this stage, the battery voltage is still applied to busbar PE via the emergency contactors and this provides the reference voltage for comparison with the generator output. The generator control unit monitors the voltage differential and at a balanced voltage of 0.3V or less the unit delivers a voltage output at pin H to energize the generator line contactor. Closure of this contactor initiates the following:

(1) Completes a circuit to enable the busbars PS1 and PS2 to be paralleled if required.



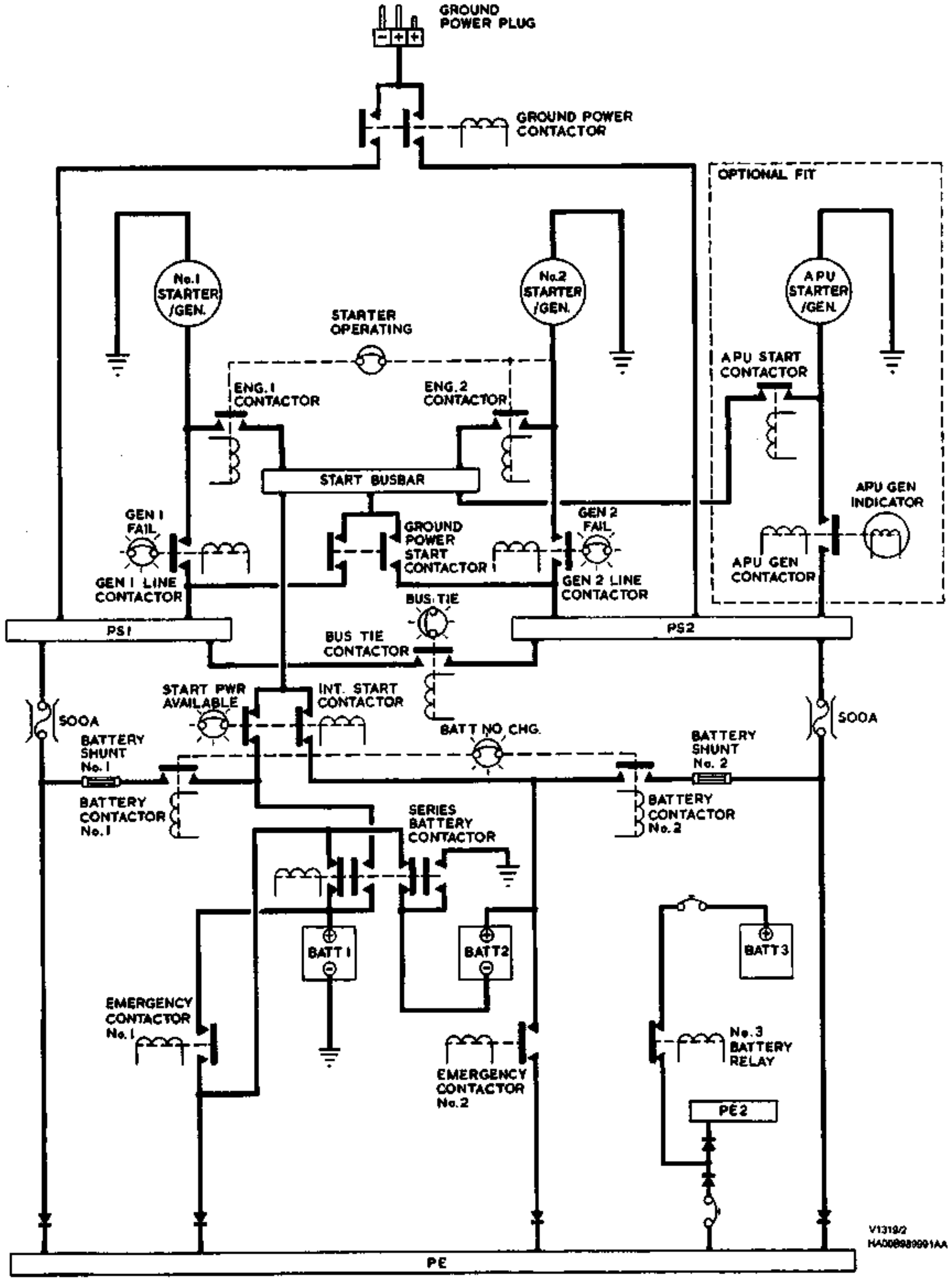
Ground power connected

*Figure 2*



Internal start - normal

*Figure 3*



Internal start with 'cold start' operating

*Figure 4*

(2) Energizes the corresponding battery contactor (battery switch at NORMAL or EMERG) to provide busbar backing and enable the batteries to be charged.

(3) Breaks the supply to the relevant GEN FAIL lamp.

A similar sequence of events exists when the external supply is used except that the internal start and emergency contactors remain relaxed and the supply is isolated by switching OFF the EXT PWR switch when the generators are on line.

### D. In flight engine relighting

An ENG. IGNITION switch and IGN. ON annunciator for each main engine system is provided on roof panel CG. The switch when selected ON, connects a supply from busbar PE to light the IGN. ON annunciator and also provide an operating supply to the igniter unit via No.2 start auxiliary relay.

### E. Cold starting facility

When the batteries have been subjected to temperatures of less than 0° C for six hours or longer it is recommended that the cold start procedure is used for engine starting. Aircraft embodying this facility embody a third battery of the nickel cadmium type rated at 24 volts 4AH. The battery connects to busbar PE2 via a circuit breaker and relay. The prime purpose of this low capacity component is to provide sufficient power to maintain satisfactory operation of engine instruments etc. during the start cycle.

The main difference between cold starting and normal start procedure is that the internal batteries are connected in series, through a heavy duty contactor, to provide a 48 volt supply at the 'start busbar'. This facility is only functional when internal batteries are used. When the external supply is connected the cold start circuit is inhibited.

In the cold starting configuration, series battery auxiliary relays are employed to form a control unit bypass circuit and connect the field coil directly to the armature circuit and thus to the starter supply whilst isolating the GCU from this supply. On cold starting a second engine however, this facility could cause overvolting of the 'on-line' (first engine) generator because unregulated voltage will be applied to its field coil. To prevent this happening the bypass circuit includes auxiliary contacts of the other engine start contactor (ESC) (e.g. No.2 ESC contacts in No.1 GCU bypass circuit) which open to inhibit the field and thus de-excite the generator.

#### Cold start procedure

With the battery master switch selected ON a supply is routed via the ground power contactor (G.P.C.), ground power start contactor (G.P.S.C.), cold start relay and series battery contactor to energize the emergency contactors which feed power to the essential busbar PE from the parallel-connected mains batteries (Chapter 24, ELECTRICAL POWER - DC GENERATION). Supplies are also routed to the START POWER switch and COLD START switch.

Pushing of the START POWER switch to ON energizes the internal start contactor which connects both main batteries, in parallel, to the 'start busbar', the START POWER AVAILABLE light is illuminated. When the COLD START switch is pushed the COLD START SELECTED lamp is illuminated and a standby positive feed is applied to normally open contacts on the start termination relay.

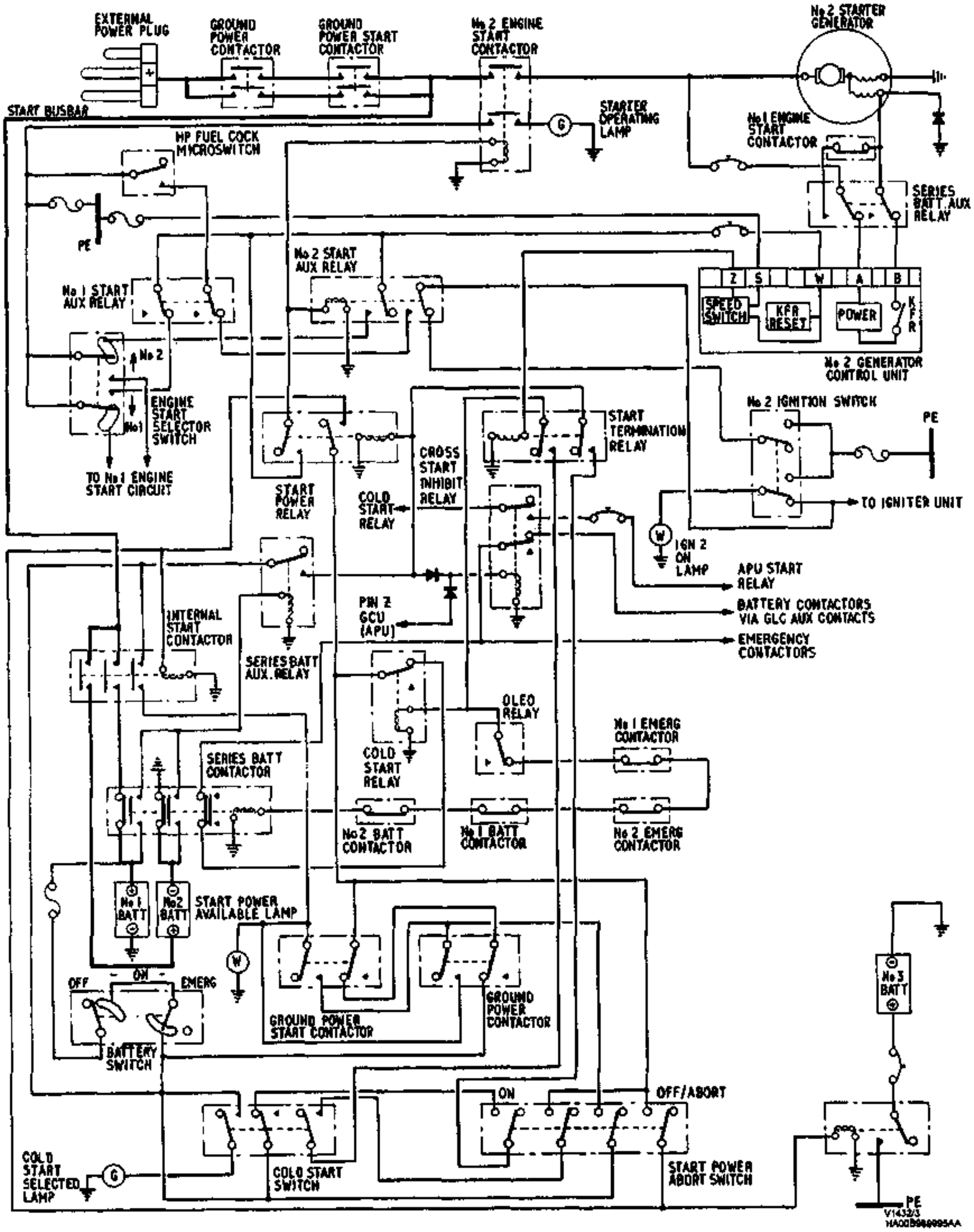
By pushing and holding the ENGINE START SELECT switch the operating coil of the start termination relay is energized and the standby supply from the COLD START switch, is routed via the now closed contacts to energize the 'cold start' relay which in turn de-energizes the emergency contactors. The supply also energizes the 'series/parallel' contactor which connects the main batteries in series and applies 48 volts to the 'start busbar'. The circuit is so wired that the contacts of both the battery and emergency contactors make sure that the series battery contactor cannot close until busbar PE has been disconnected from the batteries. Once the contactor has closed however, the busbar is supplied, directly from No.1 battery, the supply being taken from the junction of the two series-connected batteries. When the series battery contactor operates it also energizes associated auxiliary relays which operate to connect the start-generator field directly to the starter supply and also energize the start power and cross start inhibit relays. The start power relay contacts close to energize the engine start contactor and engine start auxiliary relay which apply power to the starter/generator and the ignitor unit and illuminate the engine operating light. The start power relay also provides a hold-in circuit for the internal start contactor to make sure that the series battery contactor drops out before the internal start contactor at the termination of cold start. The engine start auxiliary relay provides its own hold-in circuit which maintains supplies to the starting circuit when the ENG 2 SELECT switch is released. Auxiliary contacts on the engine start contactor open the shunt field circuit of the other generator to de-excite the generator.

**Cold start termination**

Termination of the cold starting cycle is similar to normal start termination procedure i.e. the starter/generator speed switch opening at 5,500 r.p.m. to relax the start termination relay. In the cold start circuit only, the series battery contactor is capable of terminating the start sequence. Emergency and series battery contactors are interlocked both ways so that 48 volts cannot be applied to busbar PE. Only when the series battery contactor is energized is 24 volts applied to PE from No.1 battery.

If cold start is de-selected during the start cycle the series battery contactor immediately switches the batteries to parallel and normal start will continue.

If the START POWER switch is selected to OFF/ABORT, the series battery contactor, internal start contactor and all associated relays are de-energized to terminate the start and extinguish the STARTER OPERATING lamps and START PWR AVAILABLE lamps. The interlocks between the series battery auxiliary relay and start power relay makes sure that the series battery contactor is de-energized before the internal start contactor as only the series battery contactor is capable of switching the 48 volts supply.



Starting - theoretical

*Figure 5*

# STARTING TROUBLE SHOOTING

## 1. General

**CAUTION: BEFORE ATTEMPTING ENGINE STARTS, OBSERVE ALL NECESSARY SAFETY PRECAUTIONS (CHAPTER 71, POWER PLANT - GENERAL).**

**A. The trouble shooting charts have been compiled on the assumption that:**

(1) The reported faulty system will be checked by the operator to make sure that the fault is not due to incorrect switching procedures.

(2) All relevant circuit breakers are closed, and that the circuit fuses and filaments are serviceable.

(3) External ground supplies, where used, are completely serviceable.

(4) All aircraft batteries are correctly connected and in a satisfactory state of charge.

(5) Where the term 'check' is used in connection with switches, relays, contactors etc., it implies that the operator will check the input and output voltages at the 'in use' terminals in the inoperated and operated state.

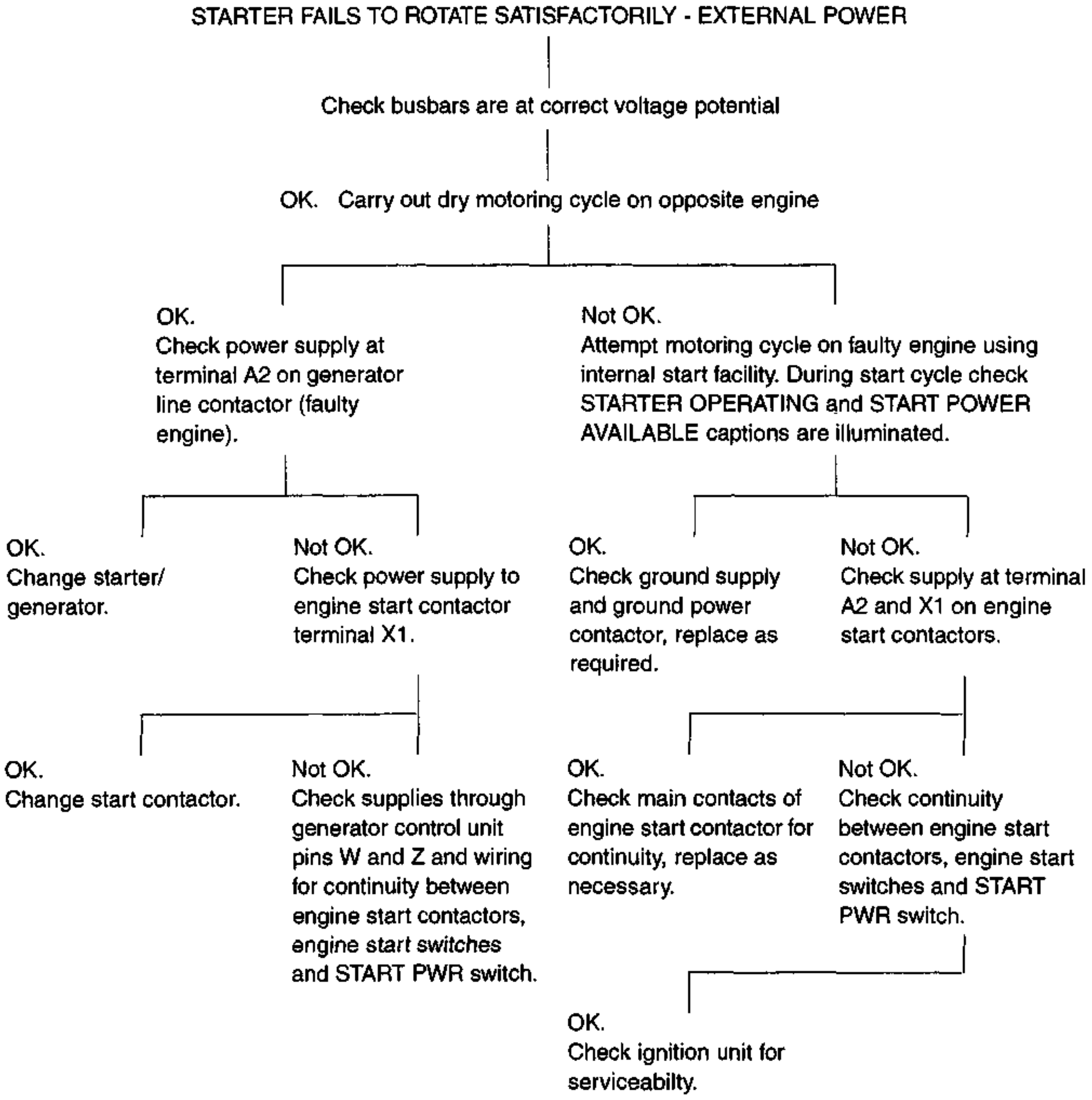
(6) The electrical connections to suspect units will be verified before removal of such units.

(7) All relevant earth connections will be verified at the various stages of fault location.

(8) Continuity checks will be done as required.

(9) Trouble shooting is not attempted without reference to the relevant routing charts.

(10) When a fault has been discovered and rectified, the system must be given a functional test as laid down in the appropriate system Maintenance Practices.



STARTER FAILS TO ROTATE SATISFACTORILY - EXTERNAL POWER

Check busbars are at correct voltage potential

OK. Carry out dry motoring cycle on opposite engine

OK. Check power supply at terminal A2 on generator line contactor (faulty engine).

OK. Change starter/ generator.

Not OK. Check power supply to engine start contactor terminal X1.

OK. Change start contactor.

Not OK. Check supplies through generator control unit pins W and Z and wiring for continuity between engine start contactors, engine start switches and START PWR switch.

Not OK. Attempt motoring cycle on faulty engine using internal start facility. During start cycle check STARTER OPERATING and START POWER AVAILABLE captions are illuminated.

OK. Check ground supply and ground power contactor, replace as required.

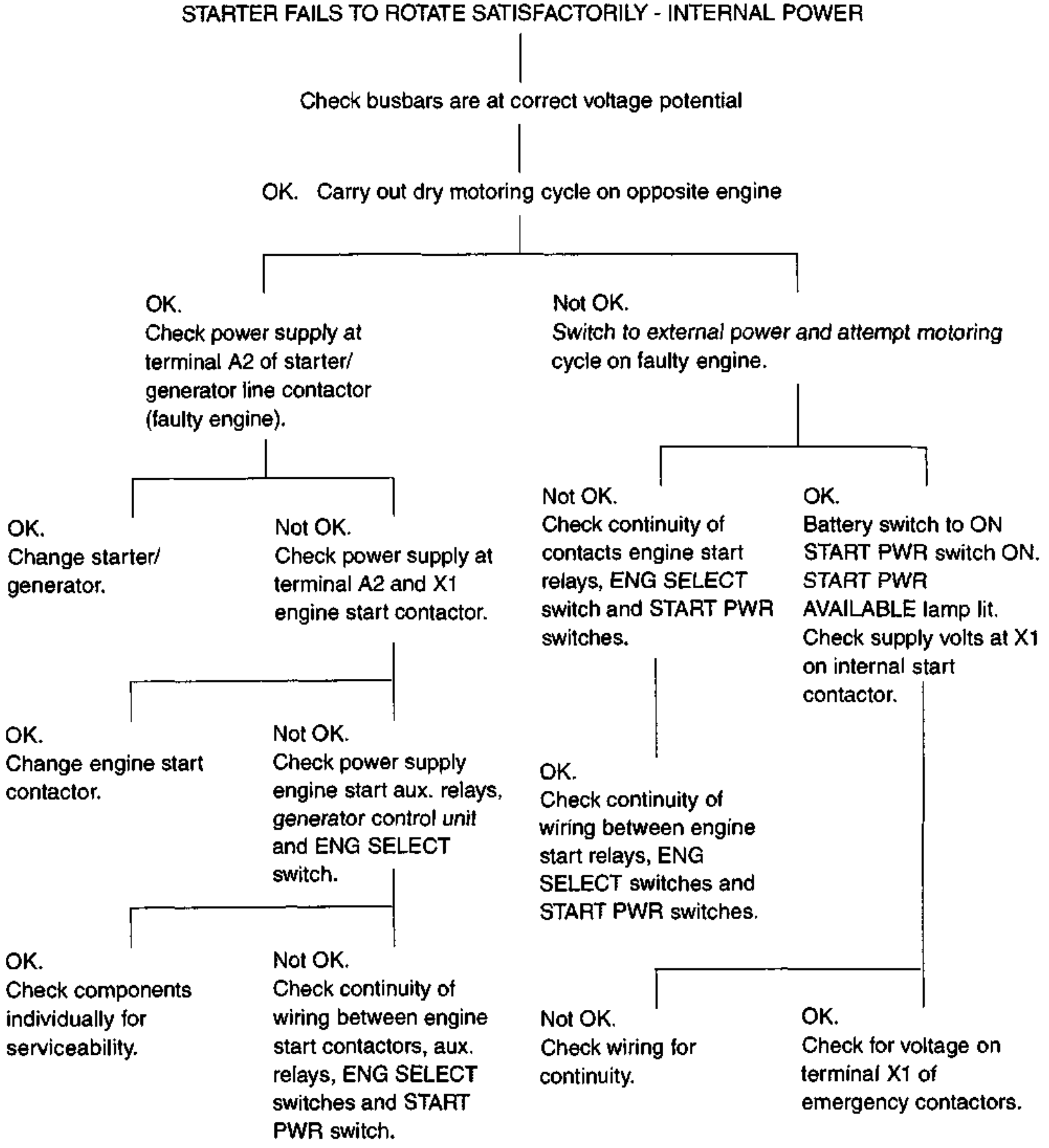
Not OK. Check supply at terminal A2 and X1 on engine start contactors.

OK. Check main contacts of engine start contactor for continuity, replace as necessary.

Not OK. Check continuity between engine start contactors, engine start switches and START PWR switch.

OK. Check ignition unit for serviceabilty.

External power
*Chart 101*



STARTER FAILS TO ROTATE SATISFACTORILY - INTERNAL POWER

Check busbars are at correct voltage potential

OK. Carry out dry motoring cycle on opposite engine

OK. Check power supply at terminal A2 of starter/ generator line contactor (faulty engine).

OK. Change starter/ generator.

Not OK. Check power supply at terminal A2 and X1 engine start contactor.

OK. Change engine start contactor.

Not OK. Check power supply engine start aux. relays, *generator control unit* and ENG SELECT switch.

OK. Check components individually for serviceability.

Not OK. Check continuity of wiring between engine start contactors, aux. relays, ENG SELECT switches and START PWR switch.

Not OK. *Switch to external power and attempt motoring cycle on faulty engine.*

Not OK. Check continuity of contacts engine start relays, ENG SELECT switch and START PWR switches.

OK. Check continuity of wiring between engine start relays, ENG SELECT switches and START PWR switches.

OK. Battery switch to ON START PWR switch ON. START PWR AVAILABLE lamp lit. Check supply volts at X1 on internal start contactor.

Not OK. Check wiring for continuity.

OK. Check for voltage on terminal X1 of emergency contactors.

Internal power
*Chart 102*

# STARTING
# ADJUSTMENT/TEST

## 1. Functionally test starting system

### A. Procedure.

(1) Start the engine, refer to Chapter 71-00-00, ADJUSTMENT/TEST.